THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS REVIEW, COPPER AND BRASS
A TRADE JOURNAL RELATING TO METALS AND ALLOYS

OLD SERIES. Vol. 19. No. 2. NEW YORK, FEBRUARY, 1913. NEW SERIES. Vol. 11. No. 2.

THE PRACTICAL METHODS EMPLOYED FOR SILVER DEPOSIT ON GLASS AND CHINA

AN ARTICLE IN WHICH IS PUBLISHED, FOR THE FIRST TIME, A RELIABLE FORMULA FOR MAKING "SILVER PAINT."

BY A. A. LE FORT.*

While there are some platers who make a practice of depositing metals on articles or objects that are non-conductors of electricity, such as wood, rubber, flowers, leaves, glass, etc., by the uses of metallic bronzes, metallic fumes and graphite, still there are very few who can work the silver (failing) or peeling off, while the loss is very large when the proper metallic paint and plating solutions are not employed. The following formula for the "Metallic Paint," which must be weighed accurately, is as follows:

EXAMPLES OF SILVER DEPOSIT WARE MADE BY THE ALVIN MANUFACTURING COMPANY, SAG HARBOR, N. Y.

the "silver deposit" on glass and china, with what would be called success, from a business standpoint.

The following process, which has passed the experimental stage and is being used successfully by leading manufacturers in that line, if followed according to directions will be found satisfactory in every way. The color will be found a clear white, which is necessary on glass objects when the work is fired properly and being fused into the glass or china, will make a firm body that will hold the deposited silver, so that there will be but a very small loss in the plating and finishing operations, due to

"Metallized Silver"	4 ozs.
Boracic acid	4 dwt.
Potassium nitrate	4 dwt.
Powdered flint	4 dwt.
Powdered glass	4 dwt.
Soda ash	4 dwt.
Red lead	4 dwt.
Calcined borax	8 dwt.

While the named ingredients are used in all paints, the weight of each may vary in different formulas, but the above will be found to be one of the best, if not the best, that is in use. In order to get the silver ready for

*Plater, Holmes & Edwards Company, Bridgeport, Conn.

use in the paint, it must be treated as follows, which is called metallizing: Either take fine silver chloride, or else cut down your own silver in the usual way, namely, one part water and one part nitric acid, in hot water bath, precipitate in the usual way with common salt, wash the chloride four or five times, then put chloride in glass or porcelain bowl and cover with a solution of two parts sulphuric acid to seven parts of water. Then cut common sheet zinc into strips of about one-half inch in width and four or five inches in length, and put them in the silver chloride and the diluted sulphuric acid, stir occasionally and keep on adding zinc until a gray or brownish colored precipitate of metallic silver is formed. Wash thoroughly until free from acid, testing with blue litmus paper to make sure. After the silver is washed, it is necessary to dry it perfectly, by drying it in a porcelain or other suitable vessel over a sand bath. Make sure that it is perfectly dry, so that there will be no error in weighing when making up the paint. If the silver is damp the weight will not be correct to conform with the other ingredients in the formula.

After weighing all the ingredients named in the formula, mix together, then thin down with oil of turpentine, grind in a paint mill, which is made for that purpose, or grind by hand, with a glass "muller" on a heavy glass or stone, which can be procured from most art or paint dealers. The grinding by hand is a long and tedious operation, as it takes a long time to do the work properly, for the paint has to be ground very fine—the finer, the better the finish will be and easier to handle, when putting on the designs. At any rate, the ingredients must be fine enough to be mixed thoroughly, as if too coarse the ingredients in the paint would divide; that is, the silver, glass and flint being very coarse would not combine correctly with the other powdered ingredients. A good way to grind the paint, which saves the cost of a paint mill and is just as satisfactory, is to make a small barrel with wooden strips, that will hold a common quart fruit jar, and is made in the form of a tumbling barrel. This is run by simply placing a belt over the shafting and around the barrel. Place the paint in the jar with about fifteen or sixteen glass marbles of different sizes, from one-half to one inch in diameter. Do not make the paint too thin; cover the jar tightly, place inside of barrel and pack around with old cloth or rags, to stop the jarring or breaking of the jar. Let the barrel run for a day or two. The marbles will grind the paint to a fineness, without any cost for labor, that could not be obtained by hand in several hours. After the paint is ground fine enough, let it settle to bottom of jar, and pour off the surplus turpentine. This paint (take only what is required for four or five hours' work, so that there will be no waste) is then mixed with "fat oil of turpentine" (about one part of oil to five or six parts of paint) on a glass surface or artist's palette with a palette knife; then thin to proper consistency with oil of turpentine by dipping the decorating brush in same and working it out on the palette. The paint should be mixed or stirred up regularly while in the act of decorating, to keep it uniform; as the oil comes to the top, and as the color of paint is brownish, it would be hard to tell whether the lines were painted with simply the oil or the paint body.

FIRING.

The second operation is the firing, which proceeds as follows: After the work is decorated let it stand five or six hours before firing, so that it is partly dry; then place in the oven, light one burner of the gas oven (which is generally used for this class of work); light a second burner in about five minutes, and the rest of the burners at about the same intervals, so that the heat will start gradually, and not make the paint blister or crack, which would be the case if a strong heat was applied too quickly. After all the burners are started, it will take from one to one and one-half hours to fire work, according to size of oven used, but the operator will have to try a few pieces, then use his own judgment as to when work is properly fired. After four or five trials, he should be able to get correct results. The oven should be in a dark place, or in a room that can be darkened when the oven is in use, so that the operator can get the right light (when looking at the work being fired) through the openings in door of oven to see if proper heat is at hand. Heat the oven until the bottom, top and sides are at a cherry red heat, when the paint is then properly fused into the glass. Turn off the gas quickly by shutting off the cock in the feed pipe, then let the work cool off gradually. Do not open the door of the oven for some time—two or three hours—as the cold current of air would crack the hot glass. When cool enough to handle, take out carefully; keep the fingers or hands off the painted parts, as they would leave marks on the paint, which would be liable to blister when plating.

PLATING.

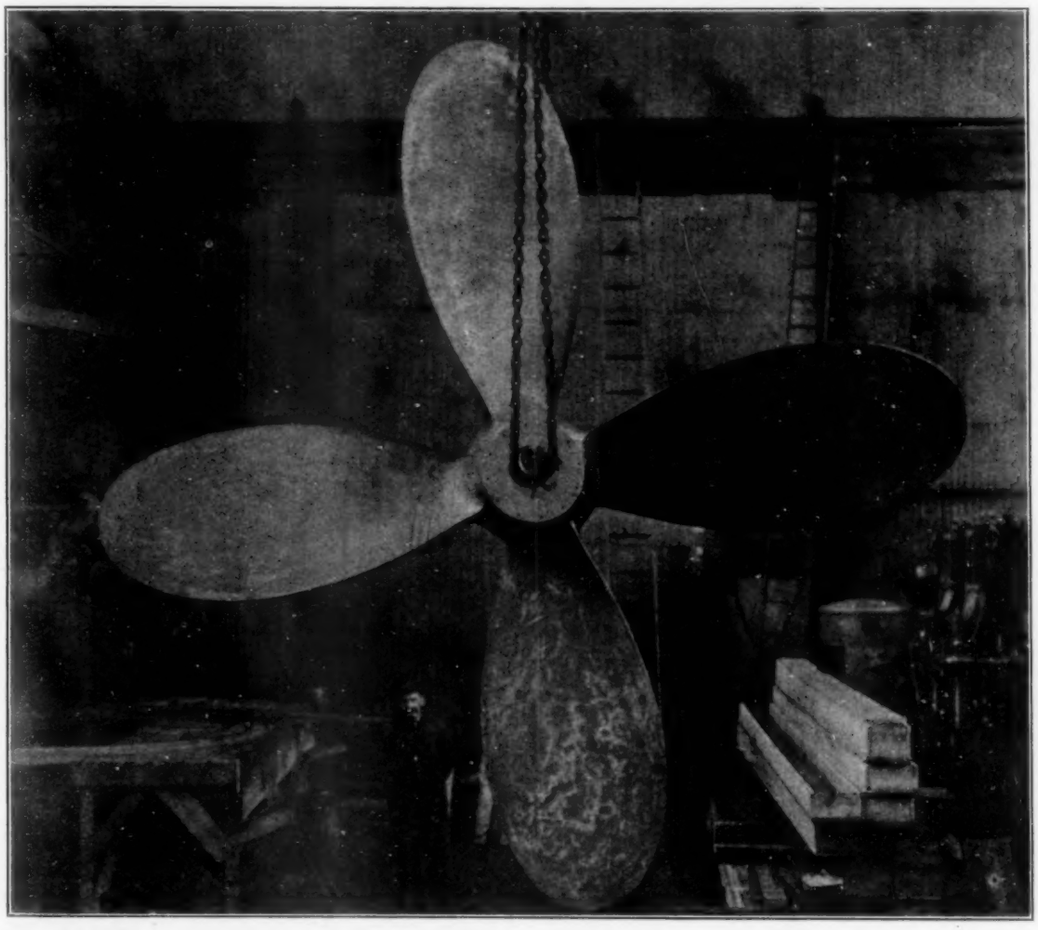
Now wire the work by making connections, directly on the painted parts. Some designs which are not connected will, of course, have to have a separate wire on each part, but most designs are made so that one connection is all that is required. After the work is wired, it is then ready for the plating bath without any other process of cleaning, brushing or striking up. As the silver must be desposited very slowly, it takes between twelve to twenty-four hours for a proper deposit, according to the grade of work, the articles which have to be engraved to bring out the designs taking the longer time, as all that is required for plain or scroll designs is just enough silver to stand the finishing operations. The plating solution should be composed of not less than 6 ounces silver, and not more than 1 or 1½ ounces of free cyanide to the gallon. If the solution is too light in metal or too strong in cyanide, the work will be very hard to finish, and the silver being too brittle would raise up from the edges of the painted surface in the solution or in the finishing. As it requires such a long time for plating, it is really necessary to run plating baths with storage batteries, during the night to make any headway, that is, run the dynamo while the power is going, then switch on to the batteries until the work is fully plated. Thus the work does not have to be removed from the plating tank at night and returned to solution the next day, as that would require the cleaning, rewiring and striking up of the work in order not to have any failed or peeled pieces. Every particle of space in the plating tank should be utilized in order to get in as many pieces of work as possible in every batch, and twenty-five to thirty amperes are all that are required for a batch of seventy-five or eighty pieces of mixed work; as the plating surface is very small even with a full batch of work. After the work is plated it is then sand-buffed, cut down with tripoli or other cutting down rouge, washed in benzine, engraved, then colored in the usual way; that is, finished, the same as sterling or silver-plated hollow ware. The quality of glass used must also be considered, for some glass will turn yellow before the proper heat is reached to fuse the paint, or else will get out of shape during the firing. Imported glass always gives best results, while thin articles of American glass are fairly satisfactory. The heavy, thick glass gives very poor results. China will stand and requires more heat in firing than glass, so it is advisable to fire china and glass separately to obtain the best results.

CASTING A 27,000 POUND MANGANESE BRONZE PROPELLER WHEEL

A Graphic Description of the Method Employed for Successfully Molding and Pouring a Gigantic Casting.

By W. R. Dean.*

The brass foundry department of the Hyde Windlass Company, of Bath, Maine, has just completed a very successful year, having cast during the year some large and difficult work, both in manganese bronze and in the popular 88-10-2 mixture. Among the notable achievements in manganese bronze was the successful casting of large stems 30 feet long and 6 inches in diameter for the New York Board of Water Supply; over 125 propeller blades weighing from 2,400 to 7,500 pounds, and five enormous solid bronze propeller wheels, taking from 20,000 to 30,000 pounds of metal to pour them. The largest, which has just been poured, took 30,000 pounds and weighed 27,000 pounds in the rough and 26,000 finished. We believe this to be one of the largest solid bronze wheels in the country. It is 18 feet 6 inches in diameter, with a hub 3 feet 8 inches in diameter. The second largest was 17 feet 6 inches in diameter, and weighed 20,000 pounds. After we had poured the 17-foot 6-inch wheel we thought we had about reached the capacity of our furnace and ladle, but after successfully casting the 18-foot 6-inch propeller, we have decided that we could rig up for almost any size casting. The pouring of this large wheel called for some special rigging. To start with, our largest ladle would hold only 13 tons, so to handle the other 2 tons would necessitate the bringing into play of our small ladle and our jib crane. Using the jib crane would mean a long runner to connect into the main runner. This runner was about 30 feet long and on an incline.



THE FINISHED MANGANESE BRONZE PROPELLER WHEEL WEIGHED TWENTY-SIX THOUSAND POUNDS.

*Foreman, Brass Foundry, Hyde Windlass Company, Bath, Me.

MAKING THE MOLD.

We make our wheels today somewhat differently than we did several years ago. Formerly, when the wheels we turned out were not so large, the blades were formed in a separate iron drag and cope assembled around the center spindle, the flasks for each blade being put in the oven to dry. As the wheels became larger, the foundry superintendent took a quicker and cheaper way, and the wheels are now made as follows: The drag is made up of brick walls put together with a mortar of sand and water, while the cope is an iron carcass, as shown in Fig. I. The mold under the pattern is made up of coarse sand rammed hard, then ashes, and finally a facing is put next to the pattern and all thoroughly vented. An iron pipe is placed in the drag through the brick work, and has an outlet through

the final mold. Fig. 2 shows a piece of pipe used for vent.

A propeller wheel is swept up around a center spindle, using a pattern of one blade for each blade, molding each blade separately. Fig. 2 shows the pattern for the 18-foot 6-inch wheel. This picture also shows the other blades all finished and the copes in place. When we came to use our largest carcasses (Fig. 1) for this wheel, we found it too short and narrow, so arms were added to lengthen and widen it, making it 10 feet long and 5 feet 6 inches wide, the outer edge resting on the brick wall of

FIG. 1. SHOWING IRON CARCASS USED FOR THE COPE.

the drag. Next to the pattern in the cope facing is placed and then coarse sand and all rammed hard. There being no pieces or stays to guide when taking off the cope or replacing it, a mortar of new sand and water is mixed to about the consistency of soft putty and placed all

FIG. 2. PATTERN USED FOR THE 18-FOOT-6-INCH PROPELLER WHEEL.

around the outside of the blade mold and scratch marks made connecting cope and drag for a guide. On account of the shape of the hub a drawback is made at each blade to be taken out before the pattern is withdrawn. This is made by making an iron plate with hangers in it and building the sand up on that. After each cope is rammed it is taken off and finished. It is tooled, wet-blacked and dried with the blow torch. Then the face of the drag is treated the same way, and the cope is put in place. Fig. 3 shows the final touches being put on a cope ready to be replaced. Fig. 2 shows the removal of the pattern after the cope has been taken off.

SECURING THE MOLD.

After all copes are on for good, comes the real brain work of the job, the securing of the mold. There is enormous pressure when 30,000 pounds of metal enters a mold, and it must be secured very thoroughly to withstand this pressure. An iron curbing (Figs. 4 and 5) is placed around the mold and sand rammed in between this curbing and the blade molds. After a good amount of

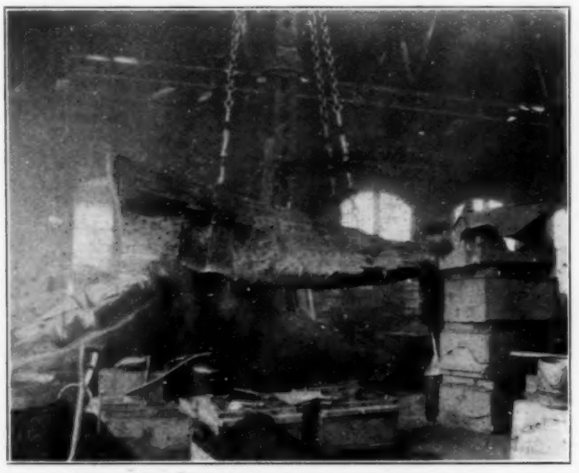


FIG. 3. TOUCHING UP THE COPE BEFORE REPLACING ON THE MOLD.

sand has been rammed, pig iron is placed on it to help hold it in place. The wheel is made up on a large iron plate, and this plate has bolt holes on the edge. Over the top, an iron plate the same diameter as the bottom one is placed and bolted to the bottom plate, resting on 6 x 6

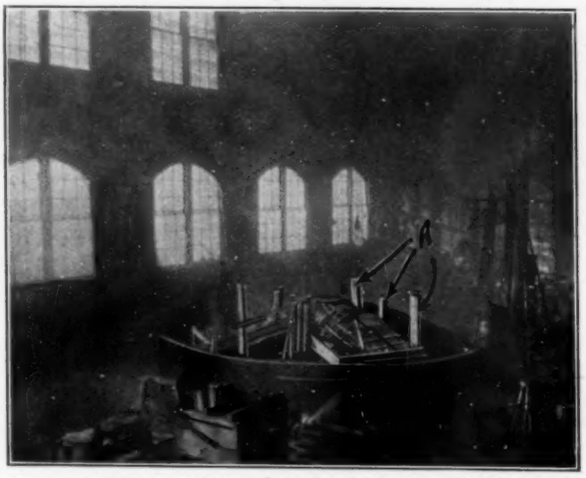


FIG. 4. SHOWING HOW THE MOLD IS HELD IN BY AN IRON BAND.

inch studding, shown in Fig. 4 at A. The plate is shown in Fig. 5, with the weights resting on it. After the plate is bolted down the copes of the blades are wedged down to keep them from lifting when pouring. After this is done thoroughly, heavy weights are placed on the plate to help hold the mold secure (Fig. 5). After all this is done the runner box is ready to be made. The wheel is under poured, that is, it is poured from the bottom, the runner entering under the hub. The runner was 5 x 5

inches at the bottom and the vertical hole about 4 x 4 inches. Then came the pouring runner, 5 x 5 inches and extending to the outer edge of the mold. Connected to this runner was the sub-runner, a long trough V-shaped and on an incline; this trough was made of wood lined with molding sand.

POURING THE MOLD.

It took ten minutes to fill the big ladle from the reverberatory furnace and three or four minutes to fill the small one. After the big one was filled the furnace was plugged as a cupola would be and the small one filled. The jib crane handled the small ladle, so while this was being filled the big crane brought the thirteen tons in the large ladle to the mold, and when the foreman said the word the pouring was started. We pour somewhat differently than others do. We do not pour fast to fill a big reservoir and let this fill the mold at a constant pressure that cannot be varied, but we control the pouring at the ladle. We did not pour this wheel hard, but just fast enough to flow good and not cause any agitation of the metal in the hub. The hub was watched for any stodge and this was held from going into the blades. While the big ladle was being poured the small ladle was brought into place to the long trough and poured, the metal joining that coming from the big ladle. During the pouring

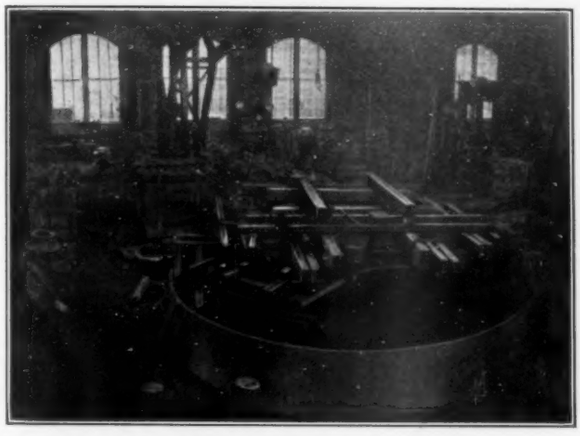


FIG. 5. THE COMPLETED MOLD, SHOWING WEIGHTS, ETC.

men were stationed at different points around the mold watching for any strain and ready to tighten up the wedges as they needed it. When the pouring was started waste was lighted at the pipe vents to touch off the gas when it formed. It took about ten minutes to pour the mold. It took just twenty-five minutes from the tapping for first bronze until the pouring was all finished.

We do not have any overflow. When the blades are full we pour slower while filling the hub and riser. Instead of having a long riser to feed the hub itself we had one 7 inches high and kept it open by churning. Four men churned for twenty minutes then four more took a turn, and so on over again for two hours. It took about 1,400 pounds of hot metal to feed the riser. By doing it this way we are sure of a solid hub. It would take an enormous riser to hold up a hub on a wheel this size. I doubt then very much if it would hold up the shrink. There would be shrink holes somewhere, even if they were not seen.

MELTING THE METAL.

For our big heats, from 1,600 pounds up, we use successfully a natural draft coal fired reverberatory furnace. We have successfully used this furnace for nineteen or twenty years in melting manganese bronze, but this heat was the largest ever poured. For a heat of this size the furnace had to be tight, so we did considerable brick work first. Then we had to make the melting chamber larger than it ever was before. We did this by digging out the bottom to the limit and banking the charging doors and putting a layer of bricks on the bridge. It took ten hours to melt the heat; that is, to bring the metal to the pouring temperature. The copper was melted first, and when this was all down the alloy was added and then the spelter. It took one and one-half hours to put in the six tons of spelter. All the melting and firing was done by one man. Two men put in the zinc, and that was all the help the melter had. The melting loss was about 7 per cent. The following day a gang of helpers were put to work knocking the mold to pieces, and by night we could see the result, which was a perfect casting. The mold was started on the 23d of November and poured the 27th of December, 1912, and occupied the attention of one molder and a helper during this time.

GERMAN MANUFACTURE OF POLISHING FELTS.

[From United States Consul General A. M. Thackara, Berlin.]

Hard felts for polishing metals, glass, and other substances have been in use in Germany for many years and are extensively manufactured in different parts of this country. The felt for polishing is usually made from sheep wool, cow and calf hair, which has been carefully cleaned to free the raw materials from sand and other impurities. After being carded the hair is subjected to a treatment of sulphuric acid and then pressed into felt by processes which vary with the degree of hardness desired. The felt is then placed in a lathe and turned to the diameter required.

For polishing metals, after the periphery of the wheel is roughened, it is covered with good Cologne glue and allowed to dry for about two hours. A paste consisting of Cologne glue and emery of a granulation depending upon the kind of polishing to be done—fine, coarse, or medium—is then applied and the surface rolled in loose dry emery of about the same granulation. After drying in a warm place for 6 to 12 hours the wheel is ready for use. For polishing or grinding glass the wheels are usually treated with a silicious varnish (wasserglas) or glue. When the first-named material is used the wheels become much harder.

GRADES, SIZES AND PRICES.

There are generally four grades of wheels used, for rough, medium, smooth, and finishing polish. Rough polishing is usually done with water mixed with powdered glass, coarse emery, or sand. The other grades of wheels are used with finer emery, polishing rouge, Vienna chalk, graphite, or white stearin. Felt wheels are made in many sizes, but those most used probably range in diameter from 43 to 105 centimeters (16.93 to 41.34 inches), with an average thickness of 20 millimeters (0.79 inch).

The following are net prices of wheels, f. o. b. Hamburg or Bremen, furnished by a prominent Silesian manufacturer of felt of all kinds, including felt grinding and polishing wheels, all 20 millimeters in thickness:

Diameter.	First Quality.	Second Quality.	Diameter.	First Quality.	Second Quality.
16.93 inches.....	$0.476	$0.417	23.62 inches.....	$0.8925	$0.714
18.89 inches.....	.571	.476	31.10 inches.....	1.304	1.071
21.26 inches.....	.655	.571	41.34 inches.....	2.856	2.023
23.23 inches.....	.833	.655			

The usual terms of sale are three months' credit, with a discount of 2 per cent. for cash within 30 days.

"ABOUT SHERARDIZING"

A Description of the Latest Practice in the Coating of Iron or Steel with Zinc.

By Thomas Liggett, Jr.

(Concluded from January.)

The continuity of the sherardizing coating, when properly applied, is equal to and in the majority of cases superior to the hot galvanized. While it is true that under the microscope the zinc iron alloy shows cracks or fissures, these are of such minute dimensions that nothing can get through to the underlying metal. The adherence of this alloy is very tenacious and is shown by the fact that a piece of sherardized material having some of its coating ground off and exposed to the weather for over two years, rust had not crept between the alloy and the underlying steel. This is not the case with either electro or hot galvanizing. It is also a very valuable property, especially on fittings or castings, as the coatings very seldom are uninjured by the time they are erected.

OHIO SHERARDIZING COMPANY, UNLOADING DRUM, DUST BIN AND LOADING DRUM.

The durability of the alloy coating is great, although it is a little more brittle than pure zinc and has a slight tendency to flake if bent through a sharp angle. The metal which is exposed after the flaking is still resistant to corrosion, and shows that the underlying metal is not exposed. The resistance of the alloy to corrosive agencies is much greater than with the zinc coatings.

Sherardized hot galvanized and electro galvanized articles were subjected to a 20 per cent. solution of sulphuric acid. The hot galvanized and sherardized articles had the same weight coating and the electro galvanized were somewhat lighter. The results show that while the sherardized coating has more iron in it than the hot galvanized, it will resist corrosion over three times as long as an equal weight coating of hot galvanizing. This is practically the same result that has been determined in England. Dr. Hinchley, of the Faraday Society, has determined that one-half ounce of sherardized coating per square foot is equal to one and one-half ounces of hot galvanizing. The claim that pure metals are more resistant to corrosion than impure metals is borne out by the above figures, as the alloy, which is a definite homogeneous compound, and pure, in that it behaves as a single metal, is more resistant to corrosion than the hot galvanized coating. The reason for this is that the impurities in the latter are not alloyed together and consequently form local couples which are likely to cause trouble.

A metallic coating to be protective must be electro positive to the underlying metal. While there are several "electro positive to iron" metals, zinc is the only one that has been found commercially useful. Some authorities claim that the more electro positive a metal is the better protection it gives, but this is disproved, as metallic calcium or sodium are not possible protective metals, yet are much more electro positive to iron than is zinc. This galvanic property becomes useful when the coating is broken and the underlying iron is exposed to corrosive agents. The surrounding protective coating becomes the anode and the galvanic current flows from the coating to the exposed iron, which is the cathode. It is this cathode current which prevents the corrosion of the iron. A coating which protects galvanically does so at its own expense, as the corrosion takes place at the anode. The more electro positive a metal is the more current flows and consequently the corrosion will be faster. Therefore the nearer the potential of the coating metal is to the underlying iron the slower will the protective coating be corroded. From this view the sherardized coating is more resistant to corrosion than either the hot or electro galvanizing as its potential is about .25 volts compared to

*Paper presented at the Buffalo meeting of the American Foundrymen's Association, September, 1912.

.53 for hot and .502 for electro galvanizing. The copper sulphate or Preece test also shows that the zinc iron alloy of the sherardized coating is more resistant than either the hot or electro galvanizing. Dr. Burgess of the University of Wisconsin has made some very careful investigations on the rate of attack on zinc and zinc iron alloy coatings and found the following:

Method of Treatment.	Loss gr. per sq. in. per dip.
Hot galvanizing	.0135
Electro galvanizing	.0131
Sherardizing with dust	.0109
Sherardizing with dross	.0082

The appearance of a newly sherardized article varies from a satin finish to a dull zinc color—this variation is due to several causes. The main thing that determines the color is the appearance or finish of the casting before treatment; the brighter and more uniform the color, the better appearance after treatment (this is one reason sand blasted material looks better than that which is pickled). Also if there is any quantity of air in the drum the material has a tendency to have a dark finish. Similarly if the drums are rotated constantly, the material is darker than if the drums are rotated intermittently. Wnen newly sherardized material is exposed to the weather it generally takes a yellowish color. This is due to the iron that is in the dust on the surface of the casting and does not come from the casting. The first good rain will wash off this yellowish color and the coating gets darker until it has finally taken a slaty black appearance—this is the final stage, and material with this appearance has shown no signs of corrosion.

As is well known, paint or enamel will not adhere to either hot or electro galvanizing with any permanence. Due to the rough exterior of sherardized surface, paint and enamel adhere firmly to the surface—this in some classes of work is a very valuable feature.

In the hot galvanizing process it is necessary to keep the kettle hot twenty-four hours a day even though it is run on a ten-hour turn. It is necessary to replace the kettle about every twelve to eighteen months. While this is not a large item of expense, it causes production loss and upsets the routine of the shop. The process is very wasteful as there are large losses due to the spelter vaporizing—loss on skimmings and dross. It has been found that these losses average 30 per cent. of the charge, and with spelter at seven cents a pound or more they are quite an item in production cost.

In the operation of the hot galvanizing process there are several steps that are wasteful and harmful to the casting. After the casting has been cleaned it is dipped in a flux and allowed to dry (in some cases). It is then plunged into the molten zinc, temperature of which varies from 900 to 1000 degs. F., or more. The casting is left in the bath until its temperature has been raised to that of the bath, so that the coating will be smooth, and then removed, and generally plunged into cold water. The result is, as Dr. Richard Moldenke says in his book, "The Production of Malleable Castings," a hard or crystallized casting in which the temper carbon has gone back. This also reduces the strength of the casting. The amount of zinc which the casting takes on cannot be regulated and in most cases there is an excess.

The electro galvanizing is little used by foundries; while for some classes of work it gives satisfactory results, it requires expensive machinery and for first class protection against corrosion the cost of production would be commercially impossible. This cost is due to high current expense and cost of zinc. Also it requires extreme care in handling the castings before treatment as any grease or oil or other dirt prevents a deposit of zinc. If the casting has a very irregular surface the hollow places fail to take a deposit and consequently are not protected. The only advantage the electro process has over the hot is, the zinc being an electrical deposit, there are no impurities in the coating to form local couples.

The sherardizing process, while the apparatus is a little more costly to install than the hot process, is much cheaper than the electro-galvanizing, and once installed has practically no maintenance charge. Establishments are still using the drums and ovens that were installed four or five years ago and from present appearances are good for four or five years more. As the deposit depends on time and heat, the excess deposit which cannot be controlled by the hot galvanizing is avoided, which is quite a saving. As there are no fumes, skimmings, or dross, this waste is eliminated. The loss of dust in a well designed plant averages from 1 to 2 per cent. As zinc dust has a low factor of heat conductivity it is impossible to subject the castings to sudden changes of temperature—this avoids crystallization and cracking of castings. While there have been no great number of tests made to determine the effect of hot galvanizing and sherardizing on the strength, the indications are that while the hot galvanizing materially reduces, the sherardizing has in some cases slightly increased the strength as compared to the plain casting. In the case of fittings and castings, screw and thread work does not need re-cutting after the treatment, as the threads and surfaces are reproduced—this gives an entirely rust proof surface.

Finally referring to the cost of sherardizing castings, it has been found that the saving is from 25 to 40 per cent. over hot galvanizing—this saving is due to less fuel being used per pound, less labor being required for equal tonnage, less zinc required for equal protection. The loss of material is practically nothing. Maintenance on plant is very low and no loss of work from cracking and crystallization.

HOW TO TEST A SILVER SOLUTION.

By Chas. A. Stiehle.*

The writer has found the following method of determining the metal in a silver plating solution to be a very simple, yet accurate, one:

Take one ounce of the solution and evaporate in a porcelain dish over a water or sand bath to dryness; then put into a small size clay crucible, about 3 inches high, adding at the same time a few pennyweights of pearl or soda ash. New put the crucible into the melting furnace, heating slowly at first, so that the contents do not boil over, then give a good heat so that the silver will melt. After taking from the fire and allowing to cool break the crucible, when the silver will be found as a button in the bottom. Now clean the silver from all flux, then weigh, and for each grain of silver in the button, multiply by 142, the number of ounces in the gallon. This will give you the amount in grains that the gallon contains. For example, the button of silver found in the crucible weighs 10 grains, then there being 142 ounces to the gallon, the gallon will contain $10 \times 142 = 1420$ grains, or 59 1/6 pennyweights of silver.

*Vice-President, National Electro-Platers' Association; and Foreman Plater, Kohn & Company, Newark, N. J.

COLUMBIA RESUMES COINAGE OF GOLD.

United States Consul Isaac A. Manning reports from Barranquilla that the Colombian Government has ordered the reopening of the Government mint at Medellin for the coinage of gold.

THE USE OF ARSENICAL COPPER FOR MAKING COLD ROLLED BRASS

By Ernest A. Lewis.*

Among the numerous statements in the literature of the metallurgy of copper of very doubtful authority, which have been published repeatedly, is one to the effect that arsenic in copper spoils it for brass making. For some time I have had my doubts of this, because in Birmingham we can turn almost any copper or scrap into the best of brass. Not only this, but for many years long before the excessively pure electrolytic coppers were thought of, we were making brass of the best quality from mixtures of "Best Selected" and tough coppers. These coppers in those days invariably contained arsenic in various quantities. Every one connected with the Birmingham brass trade knows that brass tubes and sheets are best made from a mixture of coppers. No firm with any respect for the reputation of the quality of its brass would ever dream of using all electrolytic copper for making brass, like some of our American friends do.

It astonishes American brass makers when they are told of the inferior (?) mixtures from which we make the Birmingham brass, which has a world-wide reputation, and still further does it astonish them to know that we can make brass of the highest quality from all scrap copper and brass, and only use as virgin metal sufficient spelter to make the necessary mixture. The Birmingham brass maker may be a little old-fashioned in his furnaces and his mills may not be quite as modern as the latest American mills, but he can hold his own in making brass against any brass maker in the world. Being of an experimental turn of mind and making it a rule never to accept published statements until I have proved them, I thought it would be interesting to make some experiments on the effect of arsenic on brass. The results amply confirm my suspicions, based on 17 years' experience in the manufacture of brass and copper. Arsenical copper does not make brass brittle, neither does it reduce its strength, *when arsenic is present in small quantity.*

The experiments were made on the amounts of arsenic which would be found in Birmingham brass made from a mixture of coppers. No scrap was used in the experiments. I would point out that these experiments are not laboratory experiments, they were made under ordinary mill practice, on the manufacturing scale. Eight bars were taken and numbered Nos. 1 to 8. Nos. 1 to 4 were made in the following mixtures, respectively. Copper = 62%, zinc = 38; copper = 66%, zinc = 34%; copper = 70%, zinc = 30%; copper = 75%, zinc = 25%; using two thirds electrolytic copper and one third arsenical copper. Nos. 5 to 8 were the same composition, but only electrolytic copper was used. The arsenical copper contained arsenic = .283% and oxygen = .05%. A good quality spelter was used throughout. The bars were rolled down as in ordinary practice to .162 inch. One piece, 8 x 2 inches, was cut from each bar, and the eight pieces were annealed at the same time in an electric muffle at 1,200 degs. F. These pieces were then rolled to .100 inch, a reduction of 38.3 per cent., and test pieces cut from them. One set of tests were made without further treatment and another set after annealing in the electric muffle. The following are the results:

*Consulting Metallurgist, Birmingham, England.

Unannealed samples—

No. sample.	Per cent. red. area.	Breaking strain.	Tensile strength, lbs., sq. in.	Per cent. elongation in 1 in.	Per cent. elongation in 4 ins.
1	32.40	4,015	80,915	16.50	5.60
2	43.20	3,470	68,400	23.50	7.00
3	43.40	3,572	70,950	22.00	6.50
4	45.75	3,615	72,475	25.00	7.60
5	35.75	3,920	79,175	17.00	6.75
6	43.40	3,480	69,825	22.00	6.42
7	41.30	3,470	71,700	20.00	6.00
8	45.00	3,590	73,100	22.00	6.35

Annealed samples—

No. sample.	Per cent. red. area.	Breaking strain.	Tensile strength, lbs., sq. in.	Per cent. elongation in 1 in.	Per cent. elongation in 4 ins.
1	54.10	2,425	50,200	60.00	43.50
2	61.20	2,180	44,700	79.00	61.00
3	62.75	2,145	44,000	77.00	60.00
4	61.50	2,200	44,100	78.00	57.75
5	55.85	2,475	49,450	64.00	48.25
6	60.45	2,125	43,770	72.00	57.50
7	61.15	2,160	43,600	78.00	57.75
8	60.90	2,235	44,125	74.00	58.75

Analysis of samples—

No. sample.	Per cent. copper.	Per cent. arsenic.
1	61.44	.065
2	67.43	.068
3	69.97	.068
4	74.60	.068
5	61.90	none
6	67.01	none
7	69.52	none
8	74.56	none

It will be noticed that in three of the samples which have been annealed the arsenical brass has a higher tensile strength than the electrolytic. My advise to American manufacturers of brass and copper tubes, etc., is to use arsenical copper containing on an average .35 per cent. arsenic for all tubes, sheets and rods (with the exception of copper for electrolytic purposes) and to use the scrap from this in their brass casting shops along with sufficient electrolytic copper to bring the arsenic in the finished brass to about .06 per cent. Those who follow these suggestions will get a better reputation for the quality of their goods and will be able to turn out more work from their mills.

A small quantity of arsenic in brass renders the metal more fluid, the resulting castings are cleaner and the brass is more ductile, permitting heavier reductions in rolling than in the case of brass made from the purest electrolytic coppers. It must of course be understood I am not advocating large amounts of arsenic in brass, as it would make it brittle. The maximum amount I recommend is about .06 to .08 per cent. (It must also be understood that these remarks do not apply to gun metal castings, as in this case I should not have the slightest hesitation in making the highest grade of gun metal with all arsenical copper even if it contained 0.5 per cent. arsenic. I should get a far

better tensile than the same gun metal made from al' electrolytic.

It has been pointed out in the Engineering and Mining Journal (November 23, 1912) that a leading wire drawer who used the excessively pure copper now supplied by the electrolytic refineries (and advocated by the American Society for Testing Materials, who have placed the minimum percentage of copper far too high) had to reduce the speed of his machinery, as the wire constantly broke at his old speeds, and when he specified bars containing about 99.86 to 99.88 per cent. copper he was able to increase his speeds to the old rate. What more practical proof of the unsuitability of the Standard Copper Specifications can manufacturers want, and these specifications were supposed to be drawn up to give a copper *suitable for all purposes.*

I had occasion some years ago to make some experiments on the relative resistance to corrosion of yellow metal sheathing, and I found that such sheathing made from electrolytic copper and electrolytic spelter rapidly corroded away. Another instance of the unsuitability of extremely pure metals for casting and rolling purposes. I suggest to American brass and copper sheet, tube and wire manufacturers that it is in their best interest to ignore the Standard Copper Specification altogether like we are doing in Birmingham, which is admitted to be the original home of the brass and copper trade and where we have found by long years of practical experience that the purest metals are not always the best.

A PROBLEM IN ROLLING SILVER

A correspondent of THE METAL INDUSTRY has sent us quite an interesting problem in the rolling of a silver border. The cut, Fig. 1, shows what is required. We submitted the questions given below to Ernest Dietz, and his answer is given at the end of the questions.

THE PROBLEM.

No. 1. What is the required diameter in proportion to the depth of cut on roll, and size of the hollow roll in making a hollow border the style of sample shown. I would like to roll the sample to a much lighter gauge.

TO CURVE EITHER WAY AT ANY GIVEN RADIUS IN VERTICAL POSITION.

TO CURVE EITHER WAY IN THE FLAT OR HORIZONTAL POSITION.

No. 2. Also explain, if possible, the manner used in some shops to run this same impression for any hollow roll straight, without it curling up.

No. 3. Is there any prescribed manner in which a hollow strip from a roll may be bent with any given curve or radius, as shown in sketch, in the two manners shown herewith:

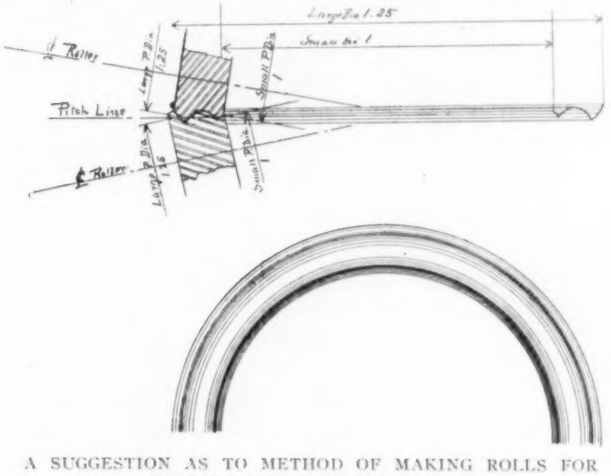
Through its width horizontally.

Through its height vertically.

THE ANSWER.

By Ernest Dietz.

The sketch, Fig. 2, shows a method I have used for determining the proportions of rolls, used for similar (although much larger) work. As you will note in rolling the shape shown in the sketch in the horizontal or flat position, the rolls are considered as a pair of truncated cones, the large and small diameters of which should bear the same ratio toward each other as the outside and inside diameter of the circular molding to be rolled. The diameters are taken at the pitch line of the shape. As a general rule in rolling this circular molding flat (as shown in sketch) the rolls should be made as small in diameter as possible, considering the depth of cut and the thickness of the metal to be rolled so as to reduce the interference of the rollers with the inner circumference of the work as much as possible. For rolling the same shape in the vertical position the diameter of the rollers should be as large as the machine and the work permits.



A SUGGESTION AS TO METHOD OF MAKING ROLLS FOR ROLLING THE HOLLOW BORDER.

A BELGIAN LEAD TRUST.

Brussels correspondence states that in order to regulate the price of lead a company has lately been formed, under the name of Compagnie Commereciale du Plomb, to which the exclusive right of selling the products from the nine lead manufacturing works existing in Belgium is confined. The first consequence is stated to have been an increase of the existing prices to such an extent that the merchants find it to their advantage to make their purchases in Germany.

THE RELATION OF CHEMISTRY TO ELECTRO-PLATING*

By Chas. F. Burgess.†

(Concluded from January.)

The electro-deposition of metals had its birth in the work of two of the world's greatest chemists, Sir Humphrey Davy and Michael Faraday. The period of their activity dates back a century, and they were followed by a number of other able chemical investigators. About the middle of the last century electro-plating was the subject of the same kind of popular interest which now attaches to wireless telegraphy, to the X-rays, and to aerial navigation. Electro-deposition was practiced not only as a means of livelihood, but also as a means of popular entertainment; electro-plating experiments were carried out in the drawing rooms as well as in the workshops. At this time, however, the only source of electricity was that supplied by primary batteries, and it was not until the '70's that the possibility of obtaining the current from the dynamo presented itself. And it was of course the advent of electrical machinery that gave to electro-plating its greatest impetus. During the early days in the development of dynamo and motor machinery, of the telephone, and the electric light, most of the scientific investigators available were devoting themselves to these new electrical fields, leaving electro-chemistry largely in the hands of practical workmen.

During recent years, however, there has been a distinct revival in the interest in electro-chemistry and electro-metallurgy as a field for the chemist and the scientific worker. Electro-plating and electro-typing have been developed mainly as an art, rather than as a science. Acknowledgment must be made to the many technical, though perhaps unscientific, workmen who have developed this wonderful art; an art which was formed through painstaking, untiring work of men not bound down by scientific prejudice, men who were willing to try anything, who did try almost everything, and who during the process got results. A present day worker in electro-plating who thinks he has made a new discovery will in all probability be able to find his discovery recorded in the literature of a half century ago, and it may, in fact, be said that one of the best ways to make new discoveries is to read the older literature. About fifteen years ago the writer believed that he was helping to perfect a new discovery in the electrolytic removal of brass from iron, this being a problem presented in the manufacture of bicycles. Sodium nitrate was used as an electrolyte and the current very quickly removed the brass from the steel tubing without in any way injuring the latter. While this was a new process as far as application was concerned, the Patent Office showed that the same discovery had been made many years before, but at a time when it could not be used practically on account of the absence of the dynamo. In like manner many of the old discoveries may not have been practical at the time that they were made, but through the advent of cheap electricity or through other modern conditions they might well be revived.

In all industries which may be designated as arts, the rule-of-thumb method largely prevails. This is true in electro-plating, and this condition will continue to prevail. But the science of electro-chemistry and of chemistry is well worthy of study by any electro-plater who is looking for opportunity for making progress. While it is true that great progress has been made without a thorough knowledge of chemistry on the part of workers, more progress would have been made with it. Bessemer worked out his revolutionary process for the manufacture of steel without knowing much about chemistry, but to make the Bessemer process practical and overcome many difficulties encountered it was necessary for the inventor to get down to a thorough study of chemistry and to use this in the analysis of his ores, his fuels, and the products. Every electro-plater knows that there are still problems and undeveloped possibilities in electro-plating, and, in fact, a knowledge of chemistry has become necessary if further progress is to be made.

I do not mean to imply that the electro-plater should reduce all of his thoughts or expressions to a scientific basis. It would be discouraging, indeed, if the practical man were felt called upon to say that an excellent smooth copper deposit can be obtained at a high current density for a copper sulphate bath by the addition of a mixture of 45 per cent. sucrose ($C_{12}H_{22}O_{11}$), 10 per cent. dextrose and leonlose ($C_6H_{12}O_6$). When, as a matter of fact, he means "molasses." On the other hand, I believe that the electro-plater has perhaps given too little attention to chemical language, terms and formulæ. This conclusion can be arrived at from much of the literature relating to practical plating problems written from the purely practical point of view.

The dependence of the electro-plater even today upon faith rather than upon chemical composition is shown in his acceptance of such materials as those which are sold under various trade names. In the iron and steel industry materials going under mysterious trade names are seldom employed; the steel worker of today must know the exact chemical composition of what he is using. In all probability the electro-plating industry would be materially benefited by similar requirements. A few years ago Professor Bancroft performed a distinct service to the electro-platers in presenting a paper entitled "The Chemistry of Electro-chemistry," in which he attempted to show the why and the wherefore of the different materials used, and of the methods employed in getting good deposits. It is far from my intention to imply that the platers of today do not understand chemistry or that they are ignorant of scientific principles. But a more special knowledge of chemistry at the assistance of such a man would be a source of profit to the user. The chemical analysis of solutions would enable the baths to be rectified and never thrown away. Fancy-named, high-priced materials would no longer be employed, and many mistakes would be avoided and the work in general made easier and more efficient.

The process of copper refining by which nearly all of the better grade copper now made is treated, could not have been worked out without the painstaking efforts of chemistry. Every electro-plater knows, or should know, that there are abundant opportunities for improvement, not only in ordinary copper plating baths, but in the development of new solutions for plating directly upon iron. Nickel plating should be improved by the discovery of solutions which will remain more constant in composition, which will corrode the anode more rapidly, and which will allow the use of higher current densities. The electro-platers' field is not restricted merely to obtaining of ornamental and protective coatings, but the entire field of electro-chemistry and electro-metallurgy lies open to him. Great interest is being displayed at the present time in the use of so-called addition agents.

*Paper presented before Chicago Branch, National Electro-Platers' Association, Chicago, Ill., December 14, 1912.

†Professor of Chemical Engineering, University of Wisconsin.

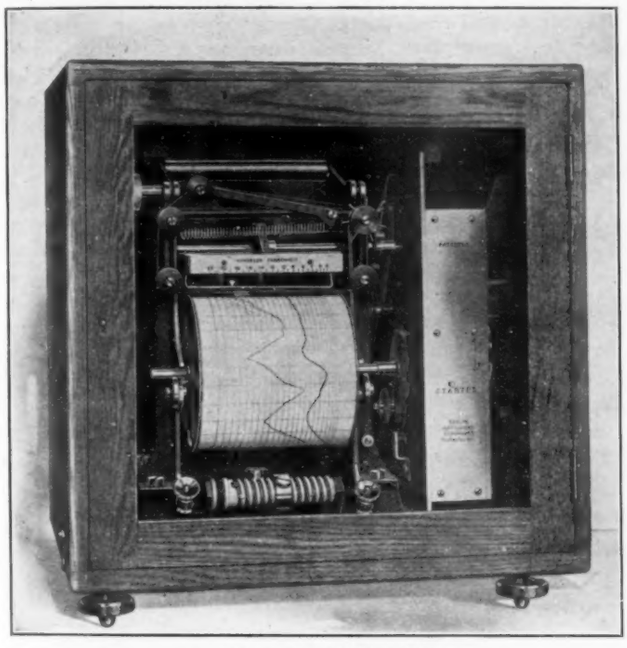
FOUNDRY PYROMETERS

SOME OBSERVATIONS REGARDING THE USE OF APPARATUS FOR MEASURING HIGH TEMPERATURES IN THE CASTING SHOP AND FOUNDRY.

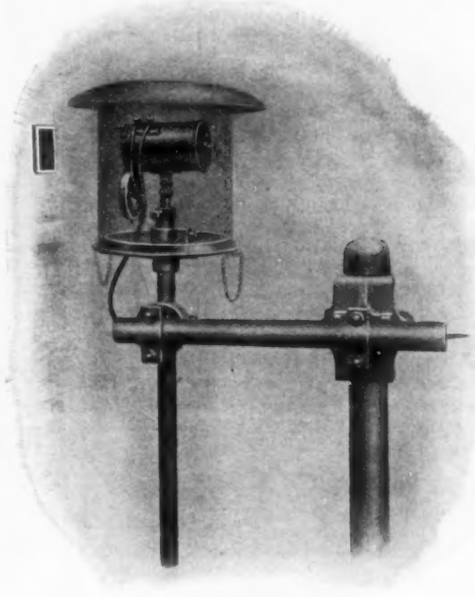
By H. W. GILLETT.

(Continued from January.)

The Fery uses a gold covered parabolic mirror and the thermo couple is moved back and forth until it is in the focus of the mirror. The others use concave or conical mirrors of aluminum foil or similar material so built that the focus is practically independent of the distance of the hot body from the instrument Unless the hot body is large enough so that the image formed by the mirror fully covers the thermo couple, we will naturally get low results, so this type demands considerable attention to the relative proportions of the hot body and the distance of the instrument from it. It requires a larger hot body or that the instrument shall be closer to the furnace than is the case with optical pyrometers. Radiation pyrometers will work at a somewhat lower temperature than optical instruments, and they have no upper limit. They are not very sensitive at the lower end of the scale but the sensitiveness increases with rising temperature, so that for very high temperatures such as those obtained in many electric furnace operations, radiation or optical instruments are the only type that is practical and are very satisfactory. The amount of heat centered on the tiny thermo couple is so small that very delicate thermo couples on galvanometers are required, thus reducing the practicability of the instrument for foundry use. Both optical and radiation instruments require a fairly skilled observer and are less portable than thermo electric types. Since fumes such as those of zinc get down the reading of radiation or optical instruments, this makes them of doubtful value in brass work. Both of these types measure not necessarily the actual temperature of a heated body, but its equivalent black body temperature. This requires a word of explanation.



TYCOS THREAD RECORDER.



FIXED FOCUS PYROMETER.

TAYLOR INSTRUMENT COMPANIES, ROCHESTER, N. Y.

If we look at a pot of molten copper on which is a piece of charcoal and some oxide scum, we will see that the charcoal is the brightest, the oxide film slightly less bright and the clear copper surface still less so; this is because the charcoal does not reflect much of any light, the copper oxide reflects a little, and the clear copper surface a great deal. A black body, or as it is more correctly termed, a complete radiator, is one which reflects or transmits no radiation. A black body has perfect emissive powers, since it is a physical law that the sum of the reflective and emissive powers of a body is unity; hence a highly reflecting body such as molten copper does not have the emissive power of one which has no reflecting powers. Any material not a perfect black body gives off less radiation than a complete radiator and when raised to a given temperature is not as bright as a black body would be. Charcoal is practically a black body, but molten metals in general are very far from one. Optical or radiation pyrometers really measure the intensity of visible or invisible radiation and so give only the temperature to which a black body would have to be heated to emit that amount of radiation, since they are all calibrated on a black body basis, hence when pointed at a body of imperfect blackness they give low readings.

Using a radiation pyrometer, C. P. Karr (THE METAL INDUSTRY, Vol. 9, page 257) gets a melting point on yellow brass 100 degs. F. lower than the true melting point on this account. These instruments could be calibrated so as to correct for this on any one alloy, but they would not then be so useful for other alloys, since different alloys vary in their approximation to black body conditions and any oxide formed will impair the accuracy of the readings. On the other hand if a clear metal surface is always sighted on, these types will give comparative readings. It is a very great advantage that no part of the instrument comes in contact with the molten metal

and hence it is not subject to rapid deterioration. Special conditions may make it possible to use these types to advantage in the foundry but in general they do not offer as great possibilities as the thermo electro type to which we will now turn our attention.

ELECTRIC PYROMETERS.

Thermo electric pyrometers probably comprise 99 per cent. of all pyrometers used in any industry. These depend upon the fact that if two dissimilar metals or alloys are joined in a closed electric circuit and the two junctions are maintained at dissimilar temperatures, an electric current is set up, the magnitude of which varies with the difference in temperature between the hot and cold junctions. If a galvanometer or other device for measuring current is included in the circuit it can be so calibrated that the deflections of the needle read directly in degrees of temperature. Some alloys give extremely weak currents, and others fairly strong ones. The value of any material for use in the thermo couple depends upon the amount of its current, on its constancy,

BROWN ELECTRIC PYROMETER. MANUFACTURED BY BROWN INSTRUMENT COMPANY, PHILADELPHIA, PA.

and on the ability of the metal or alloy to withstand the conditions under which it must be used.

Thermo electric pyrometers consist of three parts—the thermo junction, the leads, and the galvanometer. Thermo couples are divided into two classes—platinum and base metal. Platinum couples consist of one wire of pure platinum and the other of 90 per cent. platinum with 10 per cent. rhodium. These can be used up to about 2900 degs. F., and will stand constant heating to 2700 degs. without altering their calibration. There is less danger of a platinum couple losing its accuracy than of a base metal couple, hence it is preferable for a laboratory standard. The platinum couple has a low electromotive force and hence requires a very delicate galvanometer. It is expensive and must always be covered by some protecting tube since contact with molten metals, even of such low melting points as tin, instantly ruins it. Such protecting tubes of course cause more or less lag in readings.

The base metal couples are of various alloys, iron, iron with a little aluminum, pure nickel, and the alloys of nickel with chromium with aluminum, or with copper, being those most used. Most of these will stand up very well for intermittent use up to 2300 degs. F., and for quite constant use at as high as 2000 degs. F. The important points in the base metal couple are the magnitude of the electromotive force generated for a given temperature difference, since a large one allows the use of a robust high resistance galvanometer, and freedom from inversion or recalescent points and preferably a linear electromotive force temperature relation, which gives a scale of the same degree of openness throughout.

DESIGN OF FIRE RODS.

The exact design, insulation and protection of fire rods or fire ends, as base metal thermo couples are usually called, will depend on the use to which they are to be put. The leads are almost invariably copper wires and must be of the proper resistance for which the galvanometer is calibrated. By varying the diameter of the wires we may use any length of leads desired, and thus place the galvanometer as near to or as far from the fire end as we wish. The galvanometer is a millivolt meter or instrument for measuring the difference of electrical potential set up by the difference in temperature at the hot and cold ends of the couple. The best kind is the D'Arsonval type in which a coil of fine wire carrying the current moves in the field of a permanent magnet. This coil is suspended on pivots and carries an indicating needle which sweeps over a scale graduated in degrees.

REPORT OF THE AMERICAN BRASS COMPANY.

The American Brass Company, Waterbury, Conn., reports for the year ended December 31, 1912. The surplus account of the combined subsidiary companies follows:

	1912.	1911.	1910.
Net profits	$2,274,738	$1,445,542	$1,887,004
Dividends	1,050,000	.....	.....
Balance	1,224,738	.....	.....
Previous surplus	5,956,860	.....	.....
Surplus January 1, 1913	7,181,598	.....	.....

The combined balance sheet as of December 31 compares as follows:

Assets:	1912.	1911.	1910.
Real estate, machinery, tools, etc.	$11,533,087	$9,057,723	$9,203,297
Cash	839,936	841,578	902,924
Accounts receivable	4,231,364	4,101,688	3,976,374
Bills receivable	130,112	500,826	421,819
Woodlands	121,295	.....	.....
Stocks owned in other companies	1,459,128	3,137,055	3,135,650
Patents	1,000	1,000	1,000
Merchandise, raw, wrought and in process	6,254,238	5,216,885	5,154,278
Total	$24,570,164	$22,856,756	$22,795,345
Liabilities:			
Capital stock	$15,000,000	$5,550,000	$5,550,000
Current accounts and bills payable	1,388,565	1,222,724	1,689,856
Loans for parent companies	.....	2,379,756	2,304,756
Surplus	7,181,599	12,704,275	12,250,732
Reserve for contingencies	1,000,000	1,000,000	1,000,000
Total	$24,570,164	$22,856,756	$22,795,345

THE COMMERCIAL CASTING OF SOUND HIGH-CONDUCTIVITY COPPER

By Roland D. Thomson.*

[The following article gives some interesting and valuable details of the process of boronizing copper. This new method for the production of pure copper castings free from blow-holes, etc., was first described by Dr. E. Weintraub in the November, 1912, issue of THE METAL INDUSTRY.—Ed.]

The casting of pure copper by the use of boron sub-oxide is not very different from casting ordinary copper or brass, with the one exception that larger risers and gates must be used to take care of the shrinkage of this copper which is similar to that of manganese bronze. The molder must experiment a little to learn the characteristic action of this copper in the mold. If the proper allowance is made in the risers and gates, and the venting is done properly, then it becomes a very simple matter to cast pure copper. It is customary to cast in green sand molds unless the casting has sharp edges and angles, then a dry sand mold should be used. The proper mold for any particular shape or form of casting is left to the judgment of the molder, as in the casting of any other metal. Iron molds may be used to advantage where a great many of one kind of casting are to be made. When an iron mold is used the percentage, one pound of boron sub-oxide to the hundred, may be slightly decreased. In practice it will be found of advantage to soot the mold before each pouring. This sooting gradually forms a scale on the walls of the mold which gives a very smooth finish to the copper casting.

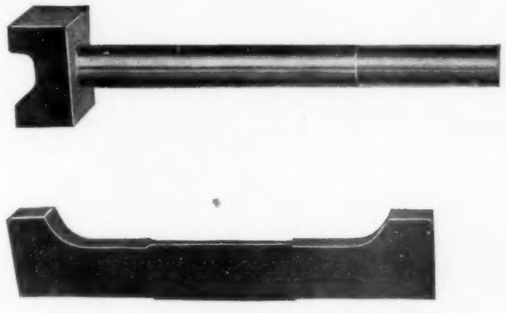


FIG. 1. 15,000 AMPERE CONTACT STUD AND SWITCH BLADE, CAST OF PURE DEOXIDIZED COPPER.

Castings have been made of a large variety of shapes and sizes from those weighing less than one pound to castings weighing five hundred pounds. The advantage may be classified under four heads:

First—Where it is necessary to have high electrical conductivity for a given area. This allows the reduction of bulk, especially where high tensile strength is not essential.

Second—Where the demand is for mechanically sound castings; for instance, in castings which are to be bored for water circulation or which must be air or steam tight.

Third—Where it is of advantage to have a combination of high electrical conductivity and mechanical soundness in the casting. Such castings are in demand in nearly every branch of electrical industry.

Fourth—Where mechanically sound castings which contain no impurities are desired. This applies to such castings as blast furnace tuyeres which are subjected to considerable heat and must be water cooled. Impurities such as zinc, tin, and so forth, are detrimental to the copper for this service. In addition, it may be added that the success of this compound lies not only in the properties of the resultant casting, but what is of far greater importance, it enables the founder to cast copper successfully just as readily as he can cast brass. The resultant casting is not an alloy, as is the case when other de-oxidizers are used; boron sub-oxide will not combine with copper. The accompanying photographs are of a few pure copper castings, cast commercially by the use of boron sub-oxide.

Fig. 1 shows an ordinary switch blade with a tapering edge. The dimensions of this casting are approximately 12 x 3 x 1¼ inches. Fig. 1 also shows a contact stud with a 1½-inch round shank and a head approximately 4 x 4 x 2½ inches. This stud was cast in an iron mold, very little finishing being required.

Fig. 2 shows a crosshead for a 3,000-ampere oil switch. The copper founder will appreciate what difficulties a casting of this nature would offer, were he to endeavor to cast it, even with a copper alloy of low conductivity. The length of this casting is approximately 24 inches and the height 6 inches. The dimensions of the legs are approximately 2 x 1 inches, and the hollow circular portion is about 6 inches in diameter with a wall ½ inch in thickness.

FIG. 2. CROSSHEAD FOR 3,000 AMPERE OIL SWITCH, CAST FROM PURE DEOXIDIZED COPPER.

Fig. 3 shows a series coil of two turns cast with its terminal blocks. The turns are approximately 10 x 4 x ¾ inches in thickness, and the terminal blocks 4 x 4 x 1¼ inches in thickness. Here we have another casting which would offer a very difficult problem, cast with ordinary copper. It is essential in all these castings to have high conductivity in order to get greater electrical efficiency.

Fig. 4 shows a casting which I doubt very much could be done in any way but by the use of pure boron de-oxidized copper. It is known as a blow-out coil and consists of terminal blocks and a spiral coil of three turns. The terminal blocks are approximately 6 x 6 inches, and are of varying thickness, while the turns are of practically 1½ inches square copper. The turns are cast 1 inch apart and afterwards squeezed together, leaving only ¼ inch space between the turns. Formerly this coil was built up of several parts containing several joints. Much labor is saved by casting the single piece, and the efficiency is greater because of the elimination of the joints and the gain in conductivity.

The useful alloys of copper comprise mixtures with zinc, tin, aluminum, silicon, phosphorus, and manganese. Zinc and tin are added in relatively large quantities to form brasses and bronzes. Aluminum, silicon, phosphorus and manganese in comparatively small quantities, and their ability to de-oxidize copper that has been needlessly exposed to the air, probably comes more frequently into play in making castings than the founder imagines, when under proper conditions it is possible to make copper castings of perfect soundness and fair conductivity with the use of these fluxes. But no worse elements than those

*Supply Department, General Electric Company, Schenectady, N. Y.

above could have been picked out from an electrical standpoint. On the other hand the elements which have but little effect upon the electrical conductivity; lead, bismuth and tellurium make the metal extremely brittle. In the last case there is a mechanical mixture in which the conductivity is only affected in proportion to the mixture, the mechanical properties of the foreign element itself being brought into play. In the other case it is copper and an alloy of copper impurity.

Boron sub-oxide presents a different action with copper than any other known de-oxidizer. It is introduced into the melted metal as an impurity and there acts as a scavenger of gases, having a greater affinity for these gases than the molten copper itself. After performing its function it appears on top of the molten metal in the slag and may be easily removed. The copper is then left free from gas and will have a conductivity corresponding approximately to that of the copper which was melted. Baron sub-oxide does not purify in the sense of removing metallic impurities, but completely de-oxidizes the copper. In order to get the highest conductivity the best grade of copper must be used, such as wire bar, pure lake or pure scrap copper.

Phosphorus and silicon, perhaps the two commonest de-oxidizers, must be added in such small quantities as to

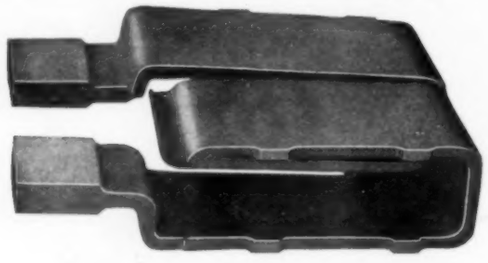


FIG. 3. SERIES COIL OF PURE COPPER, CAST IN ONE PIECE BY THE USE OF BORON SUB-OXIDE.

make the casting of this copper almost a laboratory proposition. If they are added in excess of a certain given per cent. the result will be a decided drop in the conductivity of the resultant casting. On the other hand, if boron is used in the form of boron sub-oxide it makes no difference whether the compound is added in excess of the given 1 per cent., as the excess boron merely leaves the copper with the slag, having no injurious effect upon the copper. Boron sub-oxide, therefore, is a compound which can be put into the hands of an ordinary foundry man and the result will always be the same; a pure copper casting of high electrical conductivity. Tests of copper cast by the use of boron sub-oxide show that the physical properties of the copper are what one would expect from pure cast copper. The copper is malleable, ductile, and it is denser than the ordinary cast copper, having a finer grain. The casting is readily machined and no complaint has arisen from this source.

The mechanical properties are as follows: Tensile strength, 24,350 lbs. per sq. in., or 17.0 kg. per sq. mm.; elastic limit, 11,450 lbs. per sq. in. or 8.0 kg. per sq. mm.; elongation, 48 and 5 per cent.; reduction in area, 74.49 per cent. The electrical properties are similar to that of ordinary cast copper, with the exception of the higher conductivity. The average casting made by the use of boron sub-oxide has a conductivity of 90 per cent., while as high as 97 per cent. has been obtained.

In addition to ordinary casting, boron cast copper has another interesting as well as useful application. I refer here to welding by means of cast copper. For instance, if one wishes to join a number of bars of drawn copper at the ends to a ring or terminal, the ends of the bars may be made to project into a mold and the ring or terminal may be cast to these bars. The union of the drawn and cast copper is a perfectly sound joint. The structure of the cast copper merges into that of the drawn bar, which,

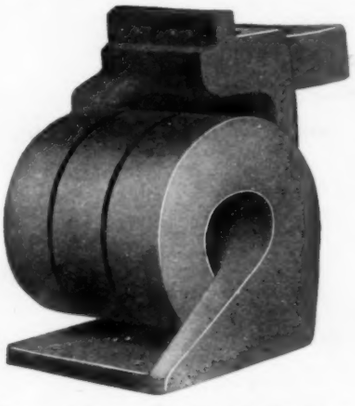


FIG. 4. BLOW-OUT COIL, CAST IN ONE PIECE BY THE USE OF BORON SUB-OXIDE. TURNS SQUEEZED TOGETHER AFTER CASTING.

of course, is annealed for a short distance from the joint. No doubt a great many applications may be made by this method of welding. As boron sub-oxide becomes more generally known as a de-oxidizer, there should be many interesting developments in the casting of pure copper, which heretofore has never been a foundry proposition. However, it must be remembered that although in many cases the pure copper casting may be used to replace forgings or drawn copper, it has limitations, due to the lack of tensile strength, which is characteristic of any cast copper. Pure cast copper may be drawn or mechanically worked and the tensile strength will increase in proportion to this working, exactly as with ordinary cast copper. The writer feels that boron sub-oxide will soon come into extensive use as a de-oxidizer, especially in castings for electrical work, because of the gain in electrical efficiency, mechanical soundness and reduction in bulk, made possible by this casting.

ELECTROPLATING PROBLEMS.

At a recent meeting of the Sheffield Society of Applied Metallurgy, Dr. R. S. Hutton, the newly elected president, said the practical application of science to the silver and electroplate industries was vital to their progress, and he emphasized the need of practical men gaining a good foundation of chemistry and physics. He also advocated a freer exchange of opinion and experience, and deprecated the policy of secretiveness and jealousy which was so prevalent in the trades referred to.

In this respect the American manufacturers set an excellent example. The present high standard of quality and excellence of work in Sheffield he attributed to the men in the plating departments. By their conscientiousness and their honesty in carrying on their work they had brought Sheffield to a position which was absolutely at the head of the silver-plating trade of the world. It was very easy to cut the deposits, to produce second-grade work, and to slur over faults in the plating, but in Sheffield houses this was strenuously opposed. The speaker went on to refer to the importance of nickel-plating aluminum, which was already being done in Germany. Other matters needing investigation were annealing, removing "fire" from silver, and the recovery of waste.

FACTORS INFLUENCING THE NATURE OF ELECTROLYTIC DEPOSITS*

By Oliver P. Watts.†

(Concluded from January.)

Slide 8 shows the effect of gas in the refining of iron. The bubbles of gas gather very slowly, and cling persistently to the cathode. It is believed to be air, not hydrogen, for in an acid solution from which hydrogen is freely evolved, it escapes readily from the cathode, and causes no trouble. It is only solutions that have stood unused for some time that make trouble. The remedy is to blow live steam into the solution before use, to expel the gas. Slide 9 shows the same trouble in a nickel solution that stood unused for three months. In this case the gas may be hydrogen instead of air. The injurious effect of insoluble matter collecting on the cathode is too well known to every plater to call for comment at this time. Slide 10 is antimony 3/16 inch in thickness deposited at 70 deg. F. from a solution containing gelatine as an addition agent. It is rough and markedly crystalline in structure. The same solution at 125 deg. F. gave a mirror-like deposit. Although the effect of temperature is frequently important, it is rarely so striking as in this case.

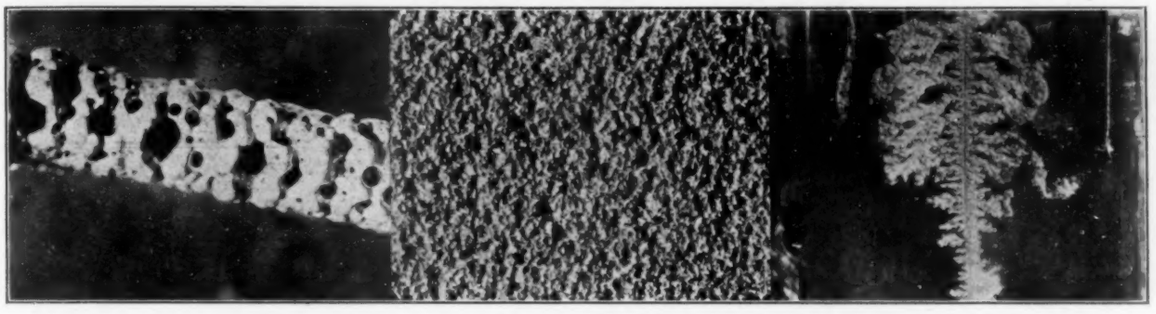


FIG. 9. GAS BUBBLES ON A HEAVY DEPOSIT OF NICKEL.

FIG. 10. THE CRYSTALLINE NATURE OF ANTIMONY DEPOSITS AT ORDINARY TEMPERATURES.

FIG. 11. ZINC DEPOSITED FROM ZINC BROMIDE.

Too high a current density on any portion of the work causes a rough, powdery deposit, technically called "burnt," from its dark color. The direct cause of a "burnt" deposit is the lack of sufficient metal in the film of solution immediately in contact with the cathode, to carry the current. Slide 11 shows the effect of high current density, poor circulation, and impoverished solution, in the electrolysis of a solution of zinc bromide for 48 hours. Treeing started at the end of several hours. The zinc bromide formed at the anodes ran directly to the bottom of the cell and formed a layer of very concentrated solution there, while the solution at the top became dilute from the deposition of its zinc. The anodes corroded off half way up, thus concentrating the entire current on the upper part of the cathode, and greatly accelerating the growth of trees. Finally the solution in the upper half became so dilute that zinc was deposited as sponge, instead of solid trees.

There is not only a downward flow of dense solution at the anodes, but there is an upward flow of impoverished solution at the cathodes. The effects of this upward flow is shown in slide 12*—the plating of copper on a horizontal tube. The smooth tube was also plated about 80 hours in the same bath after the addition of molasses. It is evident that the maximum current density allowable is dependent upon the concentration of the solution in metal, and upon the rate of circulation. Where high current density is desired, get as much metal as possible into solution, and stir it vigorously so that the film of dilute solution formed at the cathode shall be immediately removed.

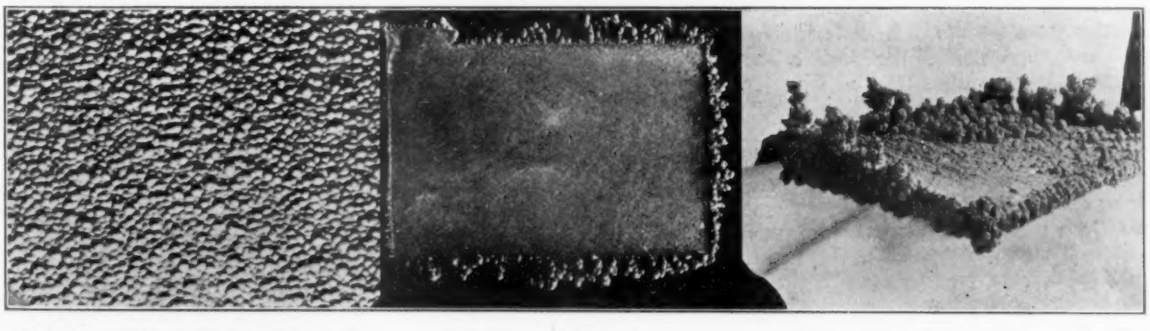


FIG. 19. DEPOSIT OF NICKEL FROM PLATING TANK AT UNIVERSITY OF WISCONSIN.

FIG. 24. COPPER PLATE.

FIG. 26. IRON CATHODE SPOILED BY FAULTY ARRANGEMENT OF ANODES.

The effect of the thickness of the deposit upon its purity and physical character concerns the refiner rather than the plater, for the latter requires a good deposit for only a couple of hours, while the refiner wants, but often fails to get, a smooth deposit for days or weeks upon the same cathode. Slide 13 shows a cathode of electrolytic iron a foot square and over an inch thick. This required a month for its deposition, and is quite as smooth as a deposit of copper or lead of equal thickness. For the first few hours it had a beautiful satiny appearance. Slide 14 shows, natural size, the broken edges of several thinner

*Paper presented before Chicago Branch, National Electro-Platers' Association, Chicago, Ill., December 14, 1912.

†Director of Electro-Plating, Laboratory of University of Wisconsin.

*It is impossible to supply a print of this, as the slide was made some years ago, and the negative cannot be found.

cathodes, while slide 15 shows one of the same slightly magnified. A short distance from the starting sheet, the dark line in the center, a peculiar basaltic or columnar structure develops. The tops of these columns are the protuberances of slide 16. Vigorous pounding with a hammer will usually loosen the cathode's teeth, which prove to be conical in shape, as seen in slide 17. The brilliant, mirror-like cavities are shown in slide 18. This singular structure is not peculiar to electrolytic iron. Thick copper and lead cathodes have the same appearance, and nickel develops a similar structure, as shown by this ten-days-old cathode—slide 19.

That this peculiar structure is not due to the electric current will be shown in the next few slides. No. 20 is an iron cathode magnified seven times, 21 is the well-known nodular hematite ore, deposited from aqueous solution undoubtedly, but not by the electric current. Limonite, manganite, and many other minerals show similar structure. Slide 22 is the fracture of hematite, and 23 that of electrolytic iron. Concerning the effect of the extent of anode surface upon the proper feeding of the solution with metal, and the maintenance of its initial acidity or neutrality, I will say nothing, as upon this subject my audience is far better able to speak than I. The few slides that follow show the effect of a bad arrangement of anodes. No. 24 is the result of using an anode much larger than the copper cathode. No. 25 shows the spoiling of an iron cathode by the complete solution of one of the three anodes which hung directly opposite the cathode, and the dissolving of half of the next anode. As a result the current was concentrated on a portion of the cathode, producing an iron forest, which is shown more clearly in slide 26. A faulty arrangement of anodes or work in the plating tank may result in a similar uneven distribution of metal, although its effects are not so readily seen in the short time allowed for plating.

It has not been possible in the limited space this paper affords, to do more than indicate some of the various factors governing the electrodeposition of metals. There are other factors concerned, also, of which no mention has been made, and the paper as a whole must be considered rather as an outline than an exposition of the subject.

ELECTRO COPPER PLATING OF GALVANIZED IRON CHAIN

With Notes on Coppering by Immersion.

By Charles H. Proctor.

Considerable difficulty is frequently experienced by platers to obtain a successful copper deposit upon galvanized iron chain and other articles finished in a like manner. In referring to galvanizing I do not mean articles that have been electro-galvanized but such as have been coated by immersion in molten zinc, analogous to a method of tinning. It is the intention of the author to give a few simple directions as to methods of manipulation in describing how to copper plate the surface of the galvanized articles, and produce a satisfactory clean surface for plating, without any manual labor such as brushing or scouring.

It is a well known fact that the success of an electro deposit depends upon the article to be plated, having a chemically clean surface. In galvanizing, by the molten method, an oxidization of the surface of the zinc occurs, which in cooling produces the well known crystallization noted upon articles that have been galvanized. The removal of this oxidization is essential to produce a clear copper deposit, when only a light deposit is required without further manipulation. If such articles are immersed in strong alkali solution at a high temperature the surface becomes dark, due to a reduction of the metal. If hydrochloric acid is used as a dip the metal is further reduced so that in either instance the surface requires scratch brushing or tumbling to obtain a bright surface. To overcome such difficulties I have found that if the articles are immersed in a dilute and only slightly warm potash or soda solution, this blackening does not occur. The oxidization can readily be removed by immersion in a hot solution of ammonium chloride in the proportion of one-half pound to each gallon of water. After a few seconds immersion in this dip, the articles may be washed and immersed in the plating bath without any further operations.

In experimenting with various formulae for copper plating to determine which would give the quickest and most satisfactory results as to rapidity of deposit and the brightness of color, the following formula, after many trials with other combinations proved superior to all:

Water	1	gallon.
Copper Trisalyt	1	pound.
Cyanide of potassium	1	ounce.
Sodium hyposulphite	⅕	ounce.

The above combination it was found had three excellent qualities: simplicity, concentration and rapidity of the deposit. At two and one-half volts the solution gave an excellent deposit upon the galvanized iron chain in one minute at a temperature of one hundred and twenty degrees. In five minutes the deposit would stand a good hard buffing; in ten minutes it could be oxidized and the surface relieved far more satisfactorily than with deposits in many baths of thirty minutes or more. The brightness of the deposit was permanent and the color was superior to that obtained from any bath made up under the older methods, and proved an ideal solution for galvanized iron work or articles made from zinc, either castings or sheet. The amount of Trisalyt used is twice the amount prescribed in the booklet of formulae issued by the manufacturers,* but as modern plating develops it is with an idea to produce salts that will give a higher concentration to the baths and essentially a higher amperage, upon the increase of which the faster rate of deposit depends. In a bath made according to the proportions given above the voltage is decreased while the amperage is considerably higher. For this reason the deposit was produced in one-third the time or less than with an ordinary bath.

Galvanized iron chain or similar articles can be coppered very satisfactorily by immersion in a bath of the following proportions:

Warm water	1	gallon.
Pulverized sulphate of copper	8	ounces.

Add sufficient 26 per cent. ammonia water to precipitate the copper and redissolve, forming a clear blue solution. This bath is to be used cold. The cleansing of the galvanized chain is the same as specified for electro-coppering with the exception that, after immersing in the ammonium chloride dip, the articles should not be rewashed in water but drained well and immersed direct into the copper solution. The deposit is produced instantly, and the chain should be removed at once, washed, immersed in a dilute cyanide solution consisting of cyanide of potassium, two ounces; water, one gallon; then washed, dried and lacquered if necessary. This method produces excellent results when a cheap finish is desired, but as with all such deposits the electro-deposit is to be preferred.

*Roessler & Hasslacher Company, New York, N. Y.

THE SILVER SOLUTION

By S. Shoeld,* Ch. E., and G. B. Hogaboom.†

(Continued from January.)

The amount of potassium cyanide to be used for making the single cyanide of silver is according to the following table:

TABLE NO. 2.

Silver.	Silver Nitrate.	Potassium Cyanide, 98 Per Cent.
1—Parts by weight	1.6	0.6
2— " " "	3.2	1.2
3— " " "	4.7	1.9
4— " " "	6.3	2.5
5— " " "	7.9	3.1
6— " " "	9.4	3.7
7— " " "	11.0	4.3
8— " " "	12.5	5.0
9— " " "	14.1	5.6
10— " " "	15.7	6.2

The operation of precipitating the silver as silver cyanide should not be done in open daylight, because the action of the strong light causes the formation of dark silver subsalts which are insoluble in potassium cyanide. The operation should be done preferably in artificial light or shaded daylight. The precipitated silver cyanide is allowed to settle. To make certain that all the silver has been precipitated a few drops of potassium cyanide solution is added to a small portion of the clear liquid. If a precipitate is formed small amounts of the potassium cyanide solution is added till after the last addition no precipitate is formed. Now the clear solution is made slightly acid to litmus with a small amount of nitric acid to make sure that no silver has gone into solution as a double cyanide. The precipitate is washed by decantation until absolutely free from acid. The washed silver cyanide is the single cyanide of silver and is now dissolved in a solution of potassium cyanide forming a solution of double cyanide of silver. (See equations.)

The amount of potassium cyanide necessary for the formation of potassium silver cyanide is the same as used for precipitating the silver out of the nitrate solution. (Table No. 2.) To the solution now made is added the necessary amount of excess or "free" cyanide of potassium, which, when the solution is new, is generally the same amount as that of the silver in the solution.

Example: It is desired to make a 100-gal. plating solution for general purposes containing 3 ozs. of silver per gallon.

Take 300 ozs. of fine silver or about 30 lbs. of silver nitrate. If the metal is used dissolve it in 19½ lbs. of nitric acid, 38 degs. Baumé, to which has been added its own volume of water. Make neutral with soda ash. Precipitate the silver as a cyanide with 11 lbs. and 12 ozs. of potassium cyanide which has been dissolved in cold water. Make slightly acid with nitric acid, taking the necessary precaution that all of the silver has been precipitated and that none has been formed into the double cyanide. Wash the precipitate at least five times or until every trace of acid has been removed. Dissolve the silver cyanide in a solution containing 31 lbs. of potassium cyanide. Add the necessary amount of water to obtain the 100 gals. This solution will contain:

Silver .....3 ozs. per gallon
Free potassium cyanide.....3 " " "

Before the solution is used for plating it should be electrolyzed a few hours. This can be done by putting a few anodes into the solution and placing on the cathode rod a porous cup filled to within 1½ ins. of the top with a strong solution of potassium cyanide. Into the porous cup is suspended from the cathode rod a piece of steel or iron which must not touch the bottom or the walls of the porous cup. A strong current is then passed through the solution a few hours.

Silver solutions in use for plating purposes may be classified as follows:

I. Strike solutions—(a) Containing copper; (b) without copper.

II. Plating solutions—(1) Light depositing solutions; (a) white deposit; (b) bright deposit. (2) Heavy depositing solutions.

Strike solutions are low in silver and high in the excess of potassium cyanide. When made new they contain:
Silver .....from ⅛ to ½ oz. per gallon
Free potassium cyanide.... " 6 " 12 ozs. " "

Sometimes the striking solution is made with copper and silver when used for steel articles. If copper anodes are used the amount of copper will rapidly increase in the solution. The pressure generally used is too low to separate any copper on the cathode. The copper in the bath is therefore useless. If it is present its only use would be to act as an indicator, so that the voltage would not get high enough to deposit copper on the cathode. A copper anode should never be used; in fact, copper used either in the solution or as an anode has probably an advantage more imagined than real.

The purpose of a striking solution is to give the articles to be plated a thin coating of silver that will adhere. This must be done rapidly so that no silver can be precipitated by chemical action. The voltage used for strike solutions is higher than that used for plating; the articles are left in the strike solution only a few seconds. The ordinary plating solution may sometimes be used as a strike through raising the voltage above normal for a few seconds when the articles are just put in and then reducing the pressure to normal used for plating. A strike solution, however, should always be used if possible.

Solutions for the purpose of producing light deposits of silver are generally comparatively low in silver and high in free potassium cyanide. For producing a light deposit in 5 or 10 minutes solutions of the following composition can be used:

Silver .....2 ozs. per gallon
Free potassium cyanide.....6 " " "

For general plating purposes and to produce a medium heavy deposit the amount of free potassium cyanide should be kept as low as possible, because the deposit is liable to become brittle with too high an amount of free potassium cyanide. For this purpose a solution can be made with this composition:

Silver .....3 ozs. per gallon
Free potassium cyanide.....3 " " "

For heavy deposits a solution should contain:
Silver .....4 ozs. per gallon
Free potassium cyanide.....4 " " "

For "deposit" work and metallized surfaces the solution should be still higher in metal:
Silver .....6 ozs. per gallon
Free potassium cyanide.....6 " " "

In this solution it is very important not to allow the amount of free cyanide to go too high, because the deposit is more liable to be coarse and brittle than in solutions of a lower gravity.

*Berkel Chemical Company, Jersey City, N. J.
†Instructor in Electro-plating, Newark (N. J.) Technical School.

Bright plating solutions are those which contain carbon bi-sulphide. The theory for the action of the carbon bi-sulphide upon plating is still not positive. It is, however, undoubtedly connected with surface tension. According to Eatvos the surface tension energy of a gram-molecule of a substance is always the same, whatever the substance may be. According to this the first layer of metal precipitated on a surface should always for the first moment be colloidal. The metal will, through the action of the electrolyte, rapidly change over to the common molecular state. The presence of carbon bi-sulphide in the bath seems to retard this action considerably and in case of light plating the surface will remain bright.

The use of bright plating solutions is not as general as supposed. The reason for this is probably that the addition of the carbon bi-sulphide is not carried out in the proper way. It must be added to the bath every day, as it is constantly evaporating. The amount used should not exceed two grains to the gallon. The best way to make the addition to the bath is, according to Field, as follows: "Add 6 ozs. carbon bi-sulphide to 1 gal. of plating solution and shake well. Out of this stock solution is added 1 oz. per day in 10 gals. of plating solution." An excess can be removed by heating the solution to about 115 degs. F., at which point the carbon bi-sulphide vaporizes. The vapors are poisonous and if present in any quantity in the air will form a very sensitive explosive. Extra precautions should be made if this method is employed to have good ventilation.

(To be continued.)

PERTINENT FACTS REGARDING FELT POLISHING WHEELS

By F. Dolge.*

It will not be the purpose of this article to discuss the relative merits of felt polishing wheels as against other kinds of polishing wheels for different kinds of work, but rather to point out to the user of felt polishing wheels some important points that ought to receive his consideration. Felt is made of wool, and necessarily it follows that the quality of felt depends on the quality of wool used and its treatment during the process of manufacture. A wheel to give good service has to be of true balance, even texture and uniform strength. Wool is strongest in its natural state, on the animal's back, therefore the less artificial treatment it receives the better. In felt polishing wheels it has been customary in order to get a nice appearing wheel to bleach the wool excessively at the expense of the strength of the fiber. A wheel made of short staple wool tears out quickly and does not do good work. Where a long staple wool is used the finish of the wheel can never be as smooth as on a wheel where a short fiber has been used. Wheels made of unbleached wools are never so white or attractive in appearance as a wheel made of bleached stock.

The use of any foreign substance such as powder, chalk, stiffening or whitening material always detracts from the life of the wheel. Experienced polishers realize that the true test of a wheel is the amount of work it will do. If the wheel is not uniform in texture and has soft spots it is apt to burn. A wheel not true in balance also represents a great waste. It is possible nowadays to secure good felt wheels that are lighter in weight for a given size and consistency than the average short fiber loaded wheel. They have not found favor with the polishers because they have not been so neat in appearance, the sides of the wheel present a rougher appearance owing to the longer fiber wool being used, and they are somewhat yellow in appearance because the wool has not been excessively bleached, but they have proven by far to be the most durable wheel in the end.

The mistake is frequently made also that the first cost of the wheel only has been considered as against a comparative test of the working qualities of wheels of different prices. The wheel with the cheapest first cost is usually the most expensive in the end on account of its short life. The larger manufacturing concerns keep accurate account of the amount of work performed by each wheel. The operator turns in his slips showing how much he has done on the old wheel before he receives a new one.

Felt wheels today are sold with definite guarantees for uniformity of texture, true balance and working qualities, and are returnable to the manufacturer if they fail to come up to the test. Guaranteed wheels for this reason are always cheapest in the end. The manufacturer who makes a definite statement over his own signature, advertising a brand which he guarantees to do certain work, gives the man using a polishing wheel a definite recourse. Whether a particular wheel manufacturer's product is bought of him direct or through a jobber does not affect this guarantee, and the jobber is equally protected with the consumer. Wheels are sold today principally in three grades, Spanish Extra for fine work, White Mexican for the greatest run of work, and Gray Mexican for less particular work.

The speed at which wheels are run for different kinds of work is important and it is also essential to have the proper consistency of wheel for the work to be done. Intelligent co-operation between the consumer and the manufacturer of felt wheels in this case often affects a great saving, and where careful tests are made it is comparatively easy to arrive at the conclusion as to what speed and what consistency will give the most satisfactory results at the least cost. It has also been found that different diameter sized wheels give varying results on different kinds of work and in shops where a comparatively little use is found for felt wheels, carelessness in this regard often causes unnecessary added expense. Find the manufacturer who takes a real interest in your polishing problems, who can make recommendations regarding your needs as a result of his wide experience, and you will find that although the first cost of the wheels per pound may be higher, the cost for the year will be materially reduced.

*The Felters Company, New York.

AMERICAN SILVER IN TURKESTAN.

In former years, when transport difficulties between Kashgar and Russian Turkestan were considerable, all the silver from which the local Chinese tael coins of Turkestan were minted was brought from China proper by cart via Lanchow. For that reason silver was scarce and had a high exchange value in comparison with that of places where the influx of silver was less restricted by physical obstacles. Now, however, according to the Indian (Government) Trade Journal, American silver is largely imported via Russia, and the result has been a local depreciation of that metal. Prices, therefore, reckoned in the local silver currency, have been on an upward grade; and, as this condition applies to all commodities alike—local produce as well as foreign goods—the price of Turkestan imports from India has participated in the rise.

COMBINATION DIES

THE FIFTH OF A SERIES OF ARTICLES ON THE MANUFACTURE OF DIES. THOSE THAT HAVE ALREADY APPEARED ARE BLANKING DIES IN MARCH, PIERCING DIES IN APRIL, GANG AND BENDING DIES IN MAY, AND DRAWING DIES IN JUNE, 1912.

BY EASY WAY.

Combination dies have been adopted on a larger scale more extensively for sheet metal production than any other fixtures, because they produce very rapidly with quick and accurate results all drawn and formed shell work. But they are not thoroughly understood by many who attempt to build or construct them, and there is difficulty experienced by the employer to get competent mechanics who can produce these dies in an up-to-date manner. Many industries that manufacture sheet metal goods consider themselves lucky to find a mechanic who has had a thorough experience in this line of die work. However, there are plenty who understand nearly all other types of dies. But if they were given a model or sample of drawn work and told to make a die or a set of dies to produce it, the chances are, even though they were first-class workmen on other dies, they would have to hesitate about the understanding or else give up with regrets.

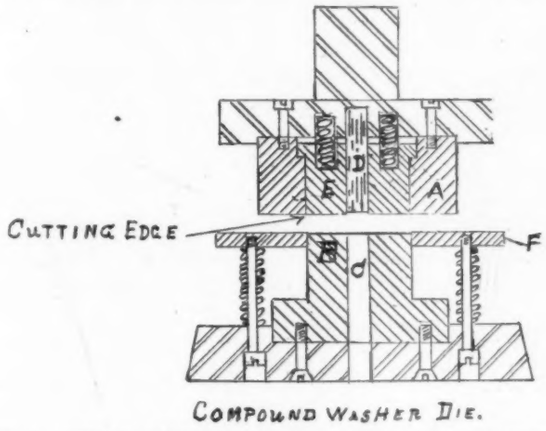


FIG. 1. SINGLE COMBINATION DIE FOR MAKING WASHERS.

Again, there are others who would try to worry the job along, but if the employer is experienced he can detect by their actions that they either know nothing of this class of work or have no conception of the rules and principles that govern the proper construction of combination fixtures.

As has been stated these dies are used for all drawn work and consist of different types, but commonly spoken of as single, double and triple action combination dies. First, that we may start in an easy way we will cite a plain round washer die with a hole pierced through the center. There are different types of these combination or "compound" dies, the same as with blanking or bending dies. The one about to be described produces the same work as a gang or tandem die, but with this difference; this die does it better and can be used with far superior satisfaction on their sheet metal. Even paper, leather or mica articles can be produced with it, that would not be thought of in a gang die. The sketches here shown together with a short description will make these dies perfectly clear to all. However, if there are any who do not understand thoroughly the construction from my description it would not be well for them to go any further. These dies must be mastered before the other types to be shown can be explained.

Referring to the sketch, Fig. 1, the upper die A receives the lower punch B, while the lower opening C receives the upper punch D. The stripper E forces the blank out of the die, while the stripper F forces the sheet off the punch B. While the sketch shown is for producing only a simple round washer, yet this general construction may be made for producing any complicated or irregular shape and to this those that

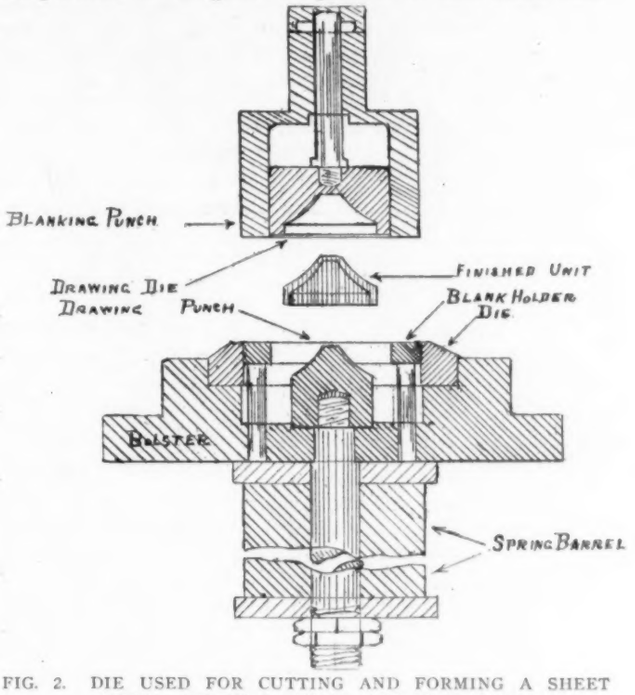


FIG. 2. DIE USED FOR CUTTING AND FORMING A SHEET METAL CUP IN A SINGLE ACTION PRESS.

are acquainted with the merits of a sub-press die construction will agree. The next sketch shown, Fig. 2, supplies plans for cutting and forming a sheet metal cup in one stroke of a single-action press. With dies of this class the first thing to look at and decide upon is the size and shape of the cup to be finished, also the thickness of the metal and last but not least, the grade of metal employed for its production. After deciding this, two templets with a difference of one thickness of metal are required, and when producing these judgment should be used as to the required degree of accuracy, for on these depends the quality of the product from the die and punch. Now that the templets are finished, start building the drawing punch and die. On their faces or ends produce the shape of the male and female templets, with all curves symmetrical and with a good finish. After cutting them off they are reversed and the holes threaded for the knock-out stud and the spring barrel stud, respectively. The bolster is next, this is faced on both sides, then bored as shown, leaving three shoulders or seats. The upper shoulder in the bolster is for the location of the blanking die. Remember the blanking die is never finished until the exact size of the blank is found by trial drawing, which will also give the size of the blank holder ring.

As the lathe work is now finished on the bolster, lay off and drill six holes equally spaced around the inside of it for the tension pins to govern the blank holder ring. The drawing-punch which has been finished is now assembled in the lobster and stationed by the spring barrel stud which shoulders against the bottom of the bolster. The spring barrel is held in position with two cast iron washers and nuts. Now the blank holder ring is produced as follows: Take a piece of tool steel about one-half inch thick, large enough for plenty of stock on the outside diameter after finishing the inside for a sliding fit to the forming punch. Then use a mandrel, the diameter of the bore in the blank holder ring and face both sides of it an even thickness. The outside diameter is left unfinished until the blanking die is hardened and ground. Now we require the blanking punch, from tool steel, with a hole bored clear through for the knock-out stud, after which it is worked out to a sliding fit for the drawing die. Next the blanking punch is placed on a mandrel and the shank turned and both ends faced, but the outside diameter is not finished; then the stud and punch are assembled. A slot is then cut in the upper end of the shank for the knock-out stud pin. The punch and die are now complete except for the cutting edges. We now set up in a press for trial draws over the forming punch and die, and test sheet metal shapes made by hand, of which keep a record for size and a scratched outline of them on a sheet of metal until the exact size and shape of the cup is found. Then the blanking die is made the same size and shape as the outline of the proven templet, allowing .020 inch for grinding after hardening and tempering, giving the bore about one degree clearance. Then assemble in the bolster stationed there with side screws. Next the blank holder ring is finished for diameter, this is hardened and tempered and also assembled in the die resting on the six tension pins. These pins must be exactly the same length, hardened and tempered. The punch is now turned, allowing .020 inch for grinding after hardening, after which it is fitted to the die by grinding on the mandrel. All that remains now is the stop pin and four stripper pins that are stationed in the bolster and the die is complete and ready to prove its worth.

(To be continued.)

HOW MUCH COAL DOES IT TAKE TO MELT A POUND OF BRASS?

By R. A. Wood.

The question is often asked, How much coal does it take to melt a pound of brass? This is a difficult question to answer because of the varying local conditions found in the different mills. These different local conditions may present themselves in various ways, as, for instance, the grade or quality of coal used, the efficiency of one melting crew as compared with that of another, and the physical characteristics, such as draught, etc., found in different melting shops. The grade of coal to be used should be carefully looked after, and a coal which will bring the metal to the right temperature for pouring before the fire begins to die out under the crucible will be found to give the best results. A grade of coal which gives good satisfaction in one foundry may not work at all well in another because of the difference in the local conditions.

In many of the shops it is customary to have the coal put into a common bin in the yard or other convenient place, and from there distributed to the different melters as occasion requires. In some other shops the coal is accurately weighed off and charged against each of the casters. It will be found by experience that the caster who has his coal weighed off against him will use less than he would were he at liberty to use it as he saw fit, and that he will turn out more metal per pound of coal than he would were there no check on his coal pile. It will be found that the personal equation of the melting crew will also enter into the question of coal consumption, and that different crews working on the same set of fires and making the same kind of metal will differ on the amount of coal consumed. In shops which do not keep a record of the coal consumed by each caster this difference is not noticed and slips by as an undetected leak in the expense account.

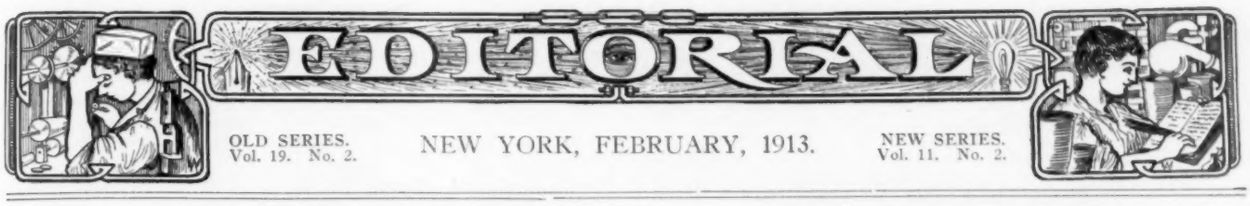
A shop which has a good, strong, natural draught equally distributed between the individual furnaces and which will melt four rounds of brass in from seven to eight hours will burn less coal than a shop equipped with a draught which takes about twelve hours to do the same amount of work. Some shops will average about a pound of metal per pound of coal, while others making the same class of work will average a little over three pounds of metal per pound of coal. The following memo. is an actual record, covering one year, of a shop employing ten casters and running double shift. This shop has a chimney over 250 feet high and the draught is so strong that you can hear it sing as it is sucked up through the flues.

Caster No.	Metal cast.	Coal used.	Metal per 100 lbs. coal.	Kind of Metal Cast
1.....	1,026,158	367,045	280	Rich bronze and German silver
2.....	1,087,290	324,120	335	Common brass
3.....	1,067,207	304,205	351	Wire bars and rods
4.....	1,152,698	357,050	323	Drawing and spinning brass
5.....	1,120,898	322,790	347	Wire bars and rods
6.....	1,249,040	369,860	330	Common brass
7.....	1,047,197	333,720	314	Spinning brass
8.....	1,094,680	388,600	282	Brazed tubing
9.....	1,157,944	323,735	358	Common brass
10.....	940,552	279,691	336	Drawing brass
	10,943,662	3,370,816	326	

The life of a crucible is also affected according to the amount of coal necessary to melt a pound of metal, as the following examples will illustrate. Mill No. 1 averages about one and one-half pounds of metal per pound of coal, and the crucibles average about twenty-five heats. Mill No. 2 averages a little over two pounds of metal per pound of coal, and the crucibles average about thirty-three heats. Mill No. 3 averages about three pounds of metal per pound of coal, and the crucibles average about forty-eight heats. It might be well to state that the same make of crucible is used in each of the examples given above.

TREASURY DECISION.

The Board of United States General Appraisers, New York, have decided that merchandise invoiced as nickel bullets is dutiable at 45 per cent. ad valorem, under paragraph 199, as metal articles not specially provided for.



OLD SERIES. Vol. 19. No. 2. NEW YORK, FEBRUARY, 1913. NEW SERIES. Vol. 11. No. 2.

THE METAL INDUSTRY

With Which are Incorporated
THE ALUMINUM WORLD
THE BRASS FOUNDER AND FINISHER
THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS

Published Monthly by
THE METAL INDUSTRY PUBLISHING COMPANY (Incorporated)

PALMER H. LANGDON - - - - - - - President and Treasurer
FREDERICK F. BURGIN - - - - - - - - - Vice-President
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Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

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ADDRESS ALL CORRESPONDENCE TO
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TELEPHONE NUMBER, JOHN 689 CABLE ADDRESS, METALUSTRY

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PRACTICAL RESEARCH

One of the principal objections to the scientific papers read before scientific societies nowadays is that they are of no value to the practical man. While such papers may be of much scientific interest to purely scientific societies, technical societies, by which we mean societies consisting of scientists and manufacturers, require a different style of paper. We propose to point out a few lines of research which require elucidation from the manufacturer's point of view. Many statements have been published at different times which are quite in variance to facts obtained in practice. We shall shortly publish an article on the use of arsenical copper for making brass sheets by cold rolling, which are the results of practical experiments on the large scale and which give quite a different version to the generally accepted theories.

A point which needs elucidating is the effect of 1 or 2 per cent. antimony on gun metal. Many hundreds of tons of gun metal made from scrap are sold containing about 10 per cent. of the tin replaced by antimony. Engineers do not mind it so long as the requisite strength can be obtained. What is wanted is a series of experiments on the manufacturing scale made on various gun metal mixtures using pure metals, with the addition of nil, 0.5, 1, 1½, and 2 per cent., etc., of antimony in place of the tin, testing the tensile strength and elongation. The same series could be repeated with arsenical copper. Every practical brass founder knows he can get a better average tensile and elongation with arsenical copper than with electrolytic copper. No one has yet suggested a satisfactory reason why it is so. The arsenic may act as a deoxidiser or it may act as a toughener, perhaps both.

If 2 per cent. of the expensive metal tin can be replaced by the cheaper metal antimony in good quality gun metals, it means a substantial saving in money, especially as the antimony does not appear to be detrimental and it only wants experiments on the manufacturing scale to prove it, say 100 pounds of alloy. The maximum amount of zinc to be added to ordinary gun metal without serious loss of strength would be valuable to engineers, as would also the minimum amount which would give sound castings. The effect of lead on the tensile of gun metal would be interesting. To get the best practical results from microscopy a standard series of photographs of different alloys cast on the manufacturing scale would be a boon to practical metallurgists. At the present time everyone must prepare his own standards, but if a series were published, just giving the mixture and

whether it was good, burnt, cast too hot or too cold, he would merely have to polish his section, etch it, look up the alloy nearest to his sample and see at once if it is burnt or whatever may be the matter with it. Nearly all published micrographs are for the expert's use, and not for the practical man. Various deoxidizers are recommended for adding to brass, bronze, German silver, and other alloys. Silicon is often recommended for this purpose, yet brass makers know that if they make brass with a silicious copper such as telephone wire it becomes hard and is quite unworkable. Practical men want to know the actual effect of deoxidisers on metals, made on the manufacturing scale or at least in pots holding 20 pounds.

Experiments made on a few ounces, as many published researches are, may easily be misleading and totally at variance with actual manufacture. Researches on steel are not usually made on a few ounces cast in a laboratory, but on large quantities taken out of actual practice, and researches on the non-ferrous metals will be useless until they are made on manufactured products. At the meetings of the American Institute of Metals, interesting practical papers have been read, especially on manganese bronze. There is, however, much work yet to be done on this type of alloy. The limits of variation in the composition with regard to its strength have not been investigated, especially the effect of aluminum and tin. Another line of research we would point out as needed by manufacturers is the effect of what used to be called the rare metals on the non-ferrous metals. Chromium and vanadium for instance. These metals are now obtainable commercially and they have been recommended for use in the non-ferrous metal trade. There is no doubt that these rare metals will come into use on the large scale before long, and those manufacturers who are enterprising enough to make use of scientific research applied to practical research will obtain the benefit of it in the long run.

COPPER SPECIFICATIONS

We publish elsewhere in this issue of THE METAL INDUSTRY a further* severe criticism of the American standard copper specifications by Ernest A. Lewis, Birmingham, England, backed up by telling practical experiments on the manufacturing scales. Mr. Lewis' condemnation of the specifications is supported by all of the leading copper metallurgists and manufacturers in England. In the light of these facts would it not be well for the American Society for Testing Materials to reconsider the present specifications? They could be withdrawn and new ones issued, or an amendment made to them whereby different kinds of copper would be recommended for different purposes. There is apparently no hope of the English users ever accepting them, and it is said American manufacturers are finding out their disadvantages.

*Other criticisms of Mr. Lewis appeared in September, 1911, and June, 1912.

NEW BOOKS

"THE JOURNAL OF THE INSTITUTE OF METALS." Vol. VIII, No. 2. 1912. Size 6 by 9 inches. 378 pages. 32 plates, including a frontispiece showing a view of the Royal United Service Institution banquet hall where the Institute of Metals reception was held September 25, 1912. Edited by the Secretary, G. Shaw Scott, Caxton House, Westminster, S. W. Published by the Institute.

The journal is issued twice a year, June and December, this being the December issue for 1912. The volume contains the May lecture delivered by Sir J. Alfred Ewing at Westminster. There is also included a full account of the fifth autumn meeting, held in London, W. C., September 25-26, 1912. The papers read at that meeting are published in full in the book, together with the photographs necessary for the clear understanding of the papers. The work contains a section devoted to abstracts of papers relating to the non-ferrous metals and the industries connected therewith. Taking it all together the eighth volume is fully up to the standard of its predecessors and shows the firm foundation upon which the Institute of Metals rests.

NATIONAL TUBE COMPANY'S BOOK OF STANDARDS. 1913. Size 6¾ by 4¼ inches. 559 pages with index. 136 illustrations. Bound in leather. Published by the National Tube Company, Pittsburgh, Pa. Price $2.00. For sale by The Metal Industry.

The 1913 edition of the Book of Standards has just been received from the press. The present edition, which is the first since 1902, is much larger and more complete than the older one. It is printed on Canterbury Bible paper and, including the binding, is not quite five-eighths of an inch thick and will fit the pocket readily. The information incorporated has made it strictly a pipe handbook and as such it is believed will find an immense use with the trade. The index of the book will be found to be very complete, all headings being thoroughly cross indexed. There are approximately 4,000 references found in the index.

Several pages are devoted to a descriptive article covering the main process of manufacturing both welded and seamless tubes, also giving information in regard to the threading, durability and physical properties, etc., of both "National" Pipe and Shelby Seamless Steel Tubes. Several pages describe, illustrate and contain tables in regard to lapweld and seamless tubes, upset and expanded, wrought pipe bends, butted and strapped joints, bump joints, valves and fittings including various kinds of nipples and flanges, hand railings and ladders, working barrels, cylinders, Shelby seamless specialties, Shelby seamless cold-drawn trolley poles, tables of various physical properties of Shelby seamless steel tubes, physical properties of carbonic acid gas, Briggs' standard, holding power of boiler tubes, thermal expansion of iron and steel tubes. There are a number of pages which give weights, dimensions, threads per inch, test pressures, sections of joints, specifications, etc., of the various kinds of pipes and tubings made.

"ELECTRO-PLATING. By William R. Barclay and Cecil H. Tainsworth. Size 5½ by 7½ inches. 399 pages and 62 illustrations, with index. Bound in red cloth. Published by Longmans, Green & Company, New York. Price $2.00. For sale by THE METAL INDUSTRY.

This work has been written primarily as a handbook for the practical electro-plater in the hope that the modern practical man will also become, at least in some degree, a scientific student, for the days of rule of thumb are rapidly passing away. On the other hand, it has not been written to produce a purely scientific treatise or laboratory manual; but, on the contrary, the authors have endeavored to combine in this book, along with the simple exposition of theoretical principles, the results of their practical experience.

The book is made up of 19 chapters and 12 appendices, which give some very valuable practical information such as explaining the things necessary for determining the thickness of electro-deposits, etc. The processes described in the book cover the deposition of most of the common metals, including gold, silver, nickel, iron, cobalt, zinc, cadmium, lead, tin, antimony, platinum, palladium, and also brass and various other alloys.

"PRACTICAL SHEET AND PLATE METAL WORK." By Evan A. Atkins, A. M. I. M. E. Municipal Technical School, Liverpool, England. Second Edition, Revised and Enlarged. Size, 5¼ by 7½ inches. 534 pages, 450 illustrations. Bound in cloth. Published by Whittaker & Company, London, E. C. Price, $2.00. For Sale by THE METAL INDUSTRY.

This work is intended for the especial use of boilermakers, braziers, coppersmiths, ironworkers, plumbers, sheet metal workers, tinsmiths, whitesmiths, zinc workers, and others who require a knowledge of the working up of metals or developments of surfaces. In this, the revised edition, a chapter has been added on annealing, acetylene welding, etc.

METALLIC ILLUSIONS

To the Editor of The Metal Industry:

In order to bring about a better understanding between the users and manufacturers of metals and alloys, I venture to request the favor of the insertion of this letter. I hope it may provoke discussion and if possible help us to arrive at the truth. Users, including the non-expert public, of metals and alloys in general, do not sufficiently realize that many of their corroded metallic wares, for example, copper pans and boilers, mysterious breakages of, for instance, chains, railway accessories, and sudden failures of condenser tubes and copper pipes, are due to two easily preventable causes described below.

In order to satisfy the demand for beauty of form or the modern craving for cheapness, many ingenious mechanical devices have been evolved by manufacturers' works staff which put upon the metallic articles while being made uneven strains or introduce in antiquated furnacing appliances, deleterious compounds, which tend to and, in varying times, finally render the articles useless in the hands of the purchasers or users. Often enough dangerous to human life and property. An attempt is made to remove these strains by annealing in unevenly heated furnaces. Why this state of things?

One must reply, "general ignorance," perhaps, "apathy"—the major causes of most human troubles.

A few manufacturers, whose products are subject to constant physical tests, are quite alive to the situation. It must also be conceded that manufacturers of ferrous and non-ferrous metals and alloys spare no pains to free them while in the molten state from deleterious substances. They employ expensive nostra known as deoxidizers, ingenious devices to prevent contact of the liquid metal with the air during the casting operations, all tending to produce soundness in the ingots or castings, i. e., to free them from blow-holes and segregations.

No sooner is this desirable end attained than the metal or alloy is introduced into furnaces wherein hot gases containing free exygen, sulphur and other objectionable elements are allowed to impinge upon or envelope the metal. While hot they are brought out of the furnace into the air and mechanically treated in an atmosphere containing oxygen. This operation is often repeated several times. In cases of cold working the metal is, with few exceptions, annealed between process in furnaces to which the air has access. After this heat-treatment they are withdrawn and allowed to cool, sometimes in approximately closed receptacles, oftener in the air. Not only is the surface of the metal oxidized or tarnished, but during the whole time of heating and partly in cooling solution of oxygen and other gases takes place with formation of compounds in intergranular spaces or in the body of the metal or alloy, which form centers or areas of corrosion when in use.

In the last year or two, exact investigations and experience have proved beyond doubt that both the above defects in heat-treatment are prolific causes of corrosion and the other breakdowns. I therefore, with all respect, beg leave to submit that the time has arrived for all engineers and users of metals and alloys to insist and specify that, at least, two causes of failure of metals and alloys under the control of the makers shall be removed, namely, (a) uneven heating appliances, (b) antiquated heat-treatment in chemically and physically active atmospheres.

Incidentally the public health will benefit because all the appliances on the market capable of bringing about the above results are smokeless when in operation. The present unnecessary and wicked waste of one of our natural resources, viz., coal, will also be curtailed.

T. Vaughan Hughes, A. R. S. M.

Birmingham, England, December, 1912.

POLISHING WHEELS

To the Editor of The Metal Industry:

Nearly every month we read an article by some writer on polishing wheels who introduces himself something like this, "Have worked at the polishing trade for the last thirty years, and can truthfully say the John Doe polishing wheel is the best on the market." For all around work it seems strange that a polisher with all that experience would make such a statement, radically misinforming some manufacturer who wonders why his foreman has not adopted the John Doe wheel. Every efficient polisher knows that there is no one polishing wheel on the market that will do all classes of work, if speed is considered. Sections of buffs soaked in glue water or similar composition, sewed buffs, bullneck, felt, sheepskin and other high-priced wheels are gradually going out. Polishers in general all work on these wheels because they have no others, and little do they care about the expense the firm is put to.

The canvas wheel can be made to do the work of any one of these wheels, quite a broad assertion to make, but it will do more work with one setting up, will not burn, will hold emery longer and will last from three to five years according to how it is worked. It can be beveled, etc., and is by far the cheapest good wheel on the market. Canvas wheels can be made to rank with our sheepskin for softness and our bullneck for hardness. Statistics will show that more canvas wheels are used today than all other wheels combined. Gluing the buff together is only throwing away money, and is only good enough for gas pipe and some stove work. It never did clean out corners of work because the edges would not hold up, and if it did it was backed up by some hard canvas or something similar which made the same soft in the center and hard on the edges.

Uniformity in wheels must be obtained first, to get the flexibility which the polisher must have to do good work. Many foremen polishers do not know that canvas can be had to suit the hardness or softness that is suitable for their work; this all lies in the weave of the goods. Making wheels hard with glue water is an old trick, which only lasts temporarily, causing a wheel to be as hard as a stone to start on and gradually getting softer and softer until it is not the wheel wanted at all. This flexibility can only be obtained in the weave of canvas, as compositions in wheels cannot be worked on long.

If finishing wheels are made of canvas, they should be made from whole discs and not from pieces. The one draw-back to the softer canvas wheel is called "tracking," which means leaving the impression of the wheel upon the work. This tracking is quite difficult for the inexperienced polisher, who must be considered by wheel manufacturers, to overcome. Tracking is due to the glue between the sections of the wheel, and it will be but a question of time until the trouble will be remedied, when manufacturers become acquainted with what is wanted.

Robert Piscator,

Foreman, Polishing Department, the Langsenkamp-Wheeler Brass Works.

Indianapolis, Ind., January 20, 1913.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ALLOYING

Q.—Would you please give me a mixture for a fluid metal for small letters?

A.—If the letters are to be made of white metal a good mixture is lead, 87; antimony, 13. For bronze letters try the following:

Copper	128
Tin	8
Zinc	4
Lead	2

—J. L. J.

CASTING

Q.—We are making art metal castings for lamps, etc., using the best Bertha spelter but find that our castings crack when taken from the mold. Will you kindly tell us what we can mix with the spelter to overcome this?

A.—"Horsehead Zinc," which usually assays 99.95 per cent. pure, gives fewer cracked castings than any other grade of zinc. The causes of the cracking may be various; lead is one of them and oxide of zinc another. Aluminum has been used to make the zinc less liable to crack, but it must be used in small amounts or it will cause trouble when the castings are plated.—J. L. J.

CLEANING

Q.—What method is best to remove the lime composition from the ground work on stove castings?

A.—There are three methods for removing lime composition from stove castings after polishing: (1) washing in gasoline or benzine, (2) boiling out in platers' compound, (3) boiling out in Mineral Cleaner. This material is probably one of the best for the purpose, and the manufacturers claim it will not tarnish the work, which is a distinct advantage, especially with nickel that frequently becomes darkened when boiled in an alkaline solution.—C. H. P.

DEOXIDIZING

Q.—Can you give us an alloy of brass that will run very cleanly and sharply? We have found that a small percentage of aluminum added to the brass, for first castings or two, is most satisfactory, as it makes the metal very fluid and the most delicate castings can be obtained, but the disadvantages of this alloy are that—first, the castings are more liable to draw, second, the aluminum seems to destroy the nature of the brass somewhat on being remelted two or three times, which causes the castings to crack in the shrinking.

A.—The probable trouble with the brass castings that have been made with the addition of aluminum is that the effect of aluminum is cumulative and very likely too much aluminum has been added. In the original mixture, not over two ounces of aluminum to the one hundred pounds of metal should be added, and then, if on further remelting, any gates, sprues or scrap that had been treated, should be used, the amount of fresh aluminum to be added must be correspondingly decreased. On the other hand if metal which has been once treated with aluminum, is remelted and the melting conditions are not carefully observed as to overheating, trouble will result from the over oxidization of the aluminum.—K.

DIPPING

Q.—Please publish a dip for gray color on brass.

A.—The solution you refer to is termed the Flemish brass dip and is prepared as follows:

Muriatic Acid	2 ounces
Powdered White Arsenic	1 ounce
Sulphuret of Potassium	1 pennyweight
Water	10 gallons

Dissolve the arsenic in the acid and then add to the water, finally add the sulphuret of potassium. It is advisable to prepare an excess of the arsenic and acid required, so that the additional amount can be used in replenishing the bath. We do not believe your dip contains oxide of iron, but it may contain a little chloride of iron. This is frequently used in such dips. Oxide of iron would be the powdered rouge used in polishing.—C. H. P.

ETCHING

Q.—What is the best method of giving an etched finish to small glass hemispheres so as to show a light frosted appearance on either the round or flat surfaces?

A.—For etching glass, either plain or figured, the sand blasting method has proven the most satisfactory and economical. See sand blast advertisements in this issue.—C. H. P.

FLUXING

Q.—When melting jewelry or fine sweeps I find that same boils over. Could you give me a remedy or flux to prevent this?

A.—A flux that does not swell unduly or have a tendency to boil over is the following:

Soda Ash (Impure Sodium Carbonate)	8 ounces
Borax Glass	2 "
Sand	1 ounce
Fluorspar	½ "

Borax should not be used in this flux, but borax-glass, as the former swells excessively.—J. L. J.

GALVANIZING

Q.—Kindly give us a zinc solution for plating direct on iron.

A.—The following formula gives excellent results for electro-galvanizing iron or steel:

Water	1 gallon
Sulphate of Zinc	1½ pounds
Sulphate of Aluminum	4 ounces
Chloride of Sodium (common salt)	2 "
Grape Sugar	¼ ounce

For still solutions use four to five volts, and for mechanical baths from five to ten volts.—C. H. P.

OXIDIZING

Q.—We are sending you a tip from a casket handle and would like to know how the oxidizing thereon is obtained.

A.—The finish of the sample submitted to us for inspection is the regular sulphuret of potassium flux oxidizing. To produce this finish plate the articles in a bright silver solution, using from 2 to 4 grams of carbon bisulphide per gallon of solution. After plating the articles are washed well in clean water and then immersed in a solution consisting of

Sulphuret of Potassium	2 ounces
Water	1 gallon

This solution should be maintained at 180 degrees F., and the articles, as soon as they are oxidized, should be washed and dried; and then buffed on a very soft wheel, using white composition for polishing. This will give you a color the same as the sample. When the oxidizing solution gives a smoky color, a fresh solution should be made up to prolong the life of the bath. It should be kept air-tight when not in use.—C. H. P.

PLATING

Q.—Can you give us information as to an electro deposit of silver on brass or gilding metal so as to stand sufficient heat to enable us to apply transparent enamels, such as are used on sterling silver enameled goods?

A.—To enable you to enamel plated articles it would be necessary for you to be extremely careful in the cleansing of the articles before plating, and with a good working solution no trouble should be experienced from the heat, as with a good homogeneous deposit the silver should become a part of the baser alloy. A silver solution for your purpose should consist of the following:

Cyanide of Silver	3 ounces
Cyanide of Potassium	6 "
Water	1 gallon

Particular attention must be paid to the voltage, which under no circumstances should exceed 1 volt.—C. H. P.

Q.—Please publish a formula for a copper solution for use on bicycle parts before nickeling.

A.—A solution consisting of the following proportions is universally used for coppering before nickel plating:

Water	1 gallon
Cyanide of Potassium	9 ounces
Carbonate of Copper	4 "
Sodium Bisulphite	2 "

The solution may be used hot or cold, but for steel parts the warm solution should be used, about 120 to 160 degrees F. In connection with the above, when a heavy coating of copper is desired, previous to nickeling or when it is necessary to produce a good high lustre, it is advisable to give the articles a good heavy deposit in the acid copper bath. This bath should consist of the following:

Water	1 gallon
Sulphate of Copper	1½ pounds
Sulphuric Acid	1 ounce
Common Black Molasses	⅓ "

The solution should be run cold and the voltage should not exceed 1½. Use anodes of heavy sheet or electrolytic copper. When using acid copper baths for depositing upon steel, it is absolutely necessary that the surface of the articles should be previously coated in the cyanide of copper bath for ten to fifteen minutes. Owing to the reducing action of iron or steel and zinc in acid copper baths, articles made from other metals should be lightly coated previous to acid coppering.—C. H. P.

RESILVERING

Q.—What is the best method of resilvering the inside of old britannia ware that is badly tarnished and pitted by long use?

A.—The following method has proven to be very satisfactory: Prepare a solution consisting of

Sulphate of Zinc	1¼ pounds
Sulphate of Aluminum	4 ounces
Common Salt	2 "
Water	1 gallon

After cleansing the inside of the old articles place enough of the solution therein to fill up, then connect the negative current to the articles and attach a piece of sheet zinc to a flexible copper wire, connected with the positive current. Now switch on a strong current and move the anode to and fro in the inside of the articles in the same manner as for gilding the inside of articles. In a few moments a sufficiently heavy adherent coating of zinc will be obtained that can be flashed over with copper, then amalgamated with the mercury dip or other methods that you prefer to use and a satisfactory surface will be produced.—C. H. P.

SOLDERING

Q.—Can you tell us the proper proportions of glycerine and muriatic acid to make a soldering flux for soldering white metal, also for German silver?

A.—For a flux for soldering white metal, such as antimonial lead and brittannia metal, the composition is as follows:

Glycerine	16 ozs. by measure
Muriatic acid	25 ozs. " "
Water	9 ozs. " "

For soldering German silver prepare the usual chloride of zinc solution by dissolving scrap sheet zinc in muriatic acid to produce a saturated solution. Then add sufficient glycerine so that the solder flows freely and no stains are produced. Solder should consist of 1½ parts of Straits tin and 1 part of lead, to produce a low melting solder.—C. H. P.

STRIKING

Q.—Please tell me how to make a strike solution in a bright silver solution for britannia metal.

A.—To produce a silver strike for britannia work, dissolve 8 ounces of cyanide of potassium and ¼-ounce of chloride of silver in each gallon of water. Use 3 volts pressure. To produce a silver bath for bright plating dissolve 8 ounces of cyanide of potassium and 3 ounces of chloride of silver in each gallon of water. After the solution is prepared electrolyze the bath by using several pieces of clean sheet iron or cold rolled steel, placed upon the cathode or work pole and switch on a medium current for an hour or more. Then use the steel as anodes until the deposited silver is all removed. To produce a bright working bath, dissolve 2 grains of bisulphide of carbon in each gallon of solution in a pint of your regular solution. After adding the necessary amount of bisulphide of carbon, add four times its weight of cyanide; agitate the bottle at short intervals and when all the carbon is dissolved, add about one-half to two-thirds to the bath first, and if the articles are not sufficiently bright add the balance of the carbon so prepared. Use a voltage of one to one and one-half.—C. H. P.

STRIPPING

Q.—Can you tell us of a cheaper or better method of removing zinc from iron, in large quantities, than stripping with sulphuric acid?

A.—Caustic soda or hydrochloric acid may be used for removing zinc from iron instead of sulphuric acid. The caustic soda should be heated to near the boiling point. This will remove the zinc very quickly, forming hydrate of zinc. The hydrochloric acid dissolves the zinc from iron very rapidly, forming chloride of zinc. We are unable to state if the above methods will be any cheaper than your present one. The best prof is to make a comparative test of the three methods.—C. H. P.

TINNING

Q.—How can I treat hydrochloric acid so that it can be used as a flux in tinning metal sheets, such as copper, steel, iron, yellow metal and naval brass? Also what ingredients, other than whiting, are used on the untinned side, and what is the best and quickest method of cleaning this coating off after tinning?

A.—The solution you refer to is termed solution of chloride of zinc, or soldering flux. It is prepared by adding zinc scrap in sheet form to hydrochloric acid until a saturated solution is produced or until the acid absorbs no more of the metal. The addition of the metal should be made slowly, as considerable heat is developed by the decomposition of the metal. Frequently a little ammonium chloride (sal ammoniac) is added to the acid to increase its fluxing powers.

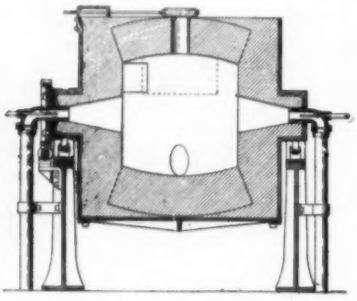
Vienna lime is used on the untinned surface. Whiting or precipitated carbonate of lime may be used satisfactorily. By immersing the tinned articles in a warm solution of cyanide of potassium the mixture can readily be removed. Also the oxidization caused by the heat of the tin. The proportions should be four ounces of cyanide of potassium or sodium to each gallon of water. After immersing in the cyanide dip the articles should be washed in clean, cold water and dried out by the aid of boiling water and sawdust or the regular heater. If a small amount of platers' compound is added to the boiling water, the sheets will dry more quickly and the brightness of the surface will be maintained.—C. H. P.

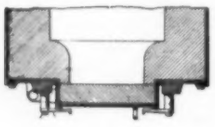
PATENTS

REVIEW OF CURRENT AMERICAN PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

1,045,528. November 26, 1912. **Melting Furnace.** Edward S. Davis, Evanston, Ill.

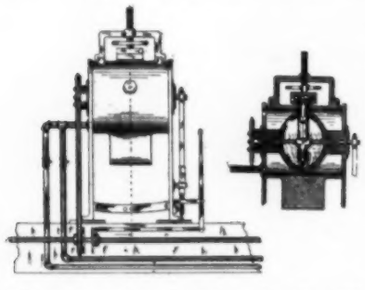
This invention relates to improvements in melting furnaces for use, more particularly, for melting non-ferrous metals and of the type known as tilting furnaces, wherein provision is made for tilting the furnace during the operation of melting the metal to a position in which the base of its pouring-spout is uncovered, in order that the spout may be heated and thus prevent the metal from chilling when it is poured from the furnace through the spout.





The object is to provide improvements in furnaces of the type above referred to, to the end of overcoming the objections to the ordinary furnace, thereby reducing the cost of construction of the furnaces and repair and replacement of the linings thereof, permitting the furnaces to be charged from a lower level than is possible as hitherto provided as shown in cut, and preferably at such a level as will permit the workmen to charge the furnaces from the floor, providing for the separation of the pouring-floor from the charging-floor, and securing greater efficiency from the fuel used without producing objectionable oxidation of the charge.

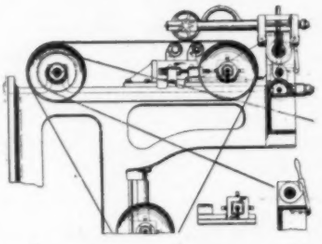
1,045,738. November 26, 1912. **Die-Casting Machines.** Layton M. Parkhurst, of Indianapolis, Ind., assignor to the Indiana Die Casting Development Company, of Indianapolis, Ind., a corporation. The object of this invention is to improve the construction and operation of die casting machines, whereby the molten metal may be forced into the die in a direct and positive manner which shall have no deteriorating effect on the metal, such as results when air is used to cause the discharge of the metal into the die. The invention is particularly adapted for use with metals having a comparatively low melting point.



The features of the invention lie in providing a die casting machine, as shown in cut, with a revoluble metal pot having a discharge passage leading from the lower part thereof and beneath the surface of the metal to which the die is secured and with a plunger within the melting pot which is caused to enter said discharge passage as the pot is revolved and force the metal into the die.

1,048,137. December 24, 1912. **Polishing Machine.** Oliver L. Dosch, of Elizabeth, N. J., assignor to the Singer Manufacturing Company, a corporation of New Jersey.

This invention has for its object to provide a polishing machine adapted for rapidly and effectively producing a smoothed polished surface upon various metallic objects, and particularly circular objects with rounded surfaces, such as sewing machine balance-wheels.

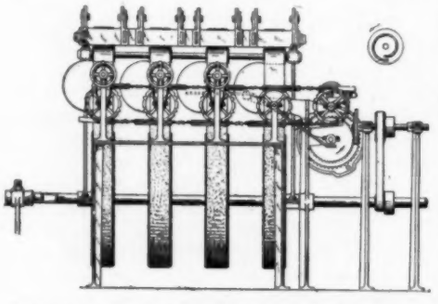


The machine embodying the present improvement, as shown in cut, is of that type, comprising supporting pulleys connected by a belt serving as a backing over which is applied a second belt provided upon its exposed face with abrading material such as emery, the article to be polished being pressed against the abrading belt in undergoing the polishing operation.

In its preferred form, the present improvement includes a gyratory work-supporting arm provided with a carrier for holding the work, such arm being pivotally mounted upon the machine frame in such manner as to maintain the work by gravity pressed against the abrading belt, the gyratory movements of the work-supporting arm causing the work to be moved to-and-fro across the abrading belt transversely of its direction of movement.

1,045,945. December 3, 1912. **Grinding and Polishing Machine.** W. J. Carney, Norwich, Conn.

This invention has for its object to provide a simple and inexpensive machine for grinding, polishing and finishing a plurality of small articles simultaneously.



The machine shown in cut is covered by 18 claims, of which one of the important ones is as follows: In a machine of the character mentioned, the combination with a carrying chain, means for imparting intermittent forward movement thereto and means for reciprocating said chain between the forward movements, of grinding and polishing belts, backing disks for said belts, a swinging frame by which said belts and disks are carried and means on said frame for regulating the tension of the belts independently.

1,048,144. December 24, 1912. **Metallurgical Furnace.** C. H. Fulton and Wm. A. Coursen, Rapid City, South Dakota.

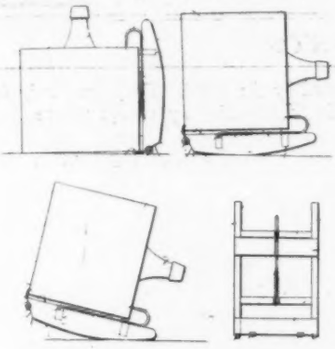
This invention relates to furnaces, and more particularly to electric resistance furnaces. The main object of the invention is to provide an electric resistance furnace which will develop uniform heat conditions throughout the heated chamber.

A further object is to provide a furnace of this character, as shown in cut, wherein the resistance material is so arranged and the current is so applied thereto as to secure equal capacity of the resistance material at every point thereof thereby securing uniform development of heat units by the said resistance material at every point about the chamber inclosed by same.

A still further object is to provide a furnace of this character wherein the heated chamber is provided with a refractory wall, having high electrical resistance and having therein a continuous chamber for the resistance material, the said furnace wall being so constructed and arranged as to avoid its racking or becoming loose when heated, or from continued use.

1,048,493. December 31, 1912. **Carboy Rocker.** Seth C. Catlin, Bloomfield, N. J.

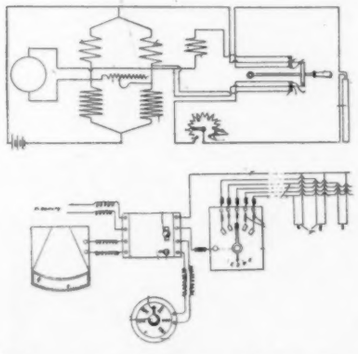
This invention relates to an improved carboy rocker, shown in cut, which is adapted to be used for tilting carboys so as to permit the safe and easy pouring of a liquid from the carboy. The rocker is adapted to be fixed to the side of a carboy and to be tilted, and has means thereon for grasping the carboy so that when the rocker is tilted the carboy comes with it, and is easily handled even when full.



The carboy rocker is made with rocker arms which have curved surfaces on which the device is rocked, these surfaces being of large radii, these radii intersecting at about the middle of the rocker arms so that the rocker arms are widest at the center, and when the rocker is swung to one side or the other of the center it has a normal tendency to retain the position in which it is placed. As the carboy becomes emptied, the distribution of its weight permits it to be held by the rocker in positions that require very little tilting to bring the fluid in the carboy to the outlet spout. The invention is further designed to provide a rocker of this kind which is quickly secured to a carboy and which is provided with rollers so that it can be used as a truck to shift the carboy from one place to another with slight effort.

1,048,930. December 31, 1912. **Electric Pyrometer.** H. Earl Bughlee, East Cleveland, Ohio.

The present invention, relating to the art of pyrometry, as indicated, has more particular regard to thermo-metric apparatus of an electric character. Of such apparatus, as is well known, there have been only two types developed that give reliable and exact results, these depending for their action, the one upon the rise in electrical resistance of a short length of platinum wire when subjected to heat, and the other upon the electro-motive force set up at the heat junction of a refractory thermo-couple. Without discussing in detail the scientific aspects of these two methods of thermo-electric pyrometry, it may be stated that the former type of apparatus, namely, the platinum resistance pyrometer is conceded in general to be the better.



The object of the present invention is the provision of such a resistance pyrometer as shown in cut, that while retaining all the advantages inherent in this system of heat measurement, will in addition be direct reading as well as susceptible of easy and frequent adjustment, thus overcoming the tendency to error that would otherwise be present in the practical use of this method.

1,049,466. January 7, 1913. **Finish-Remover.** Carleton Ellis, Larchmont, N. Y. Assignor to Chadeloid Chemical Company, New York, N. Y.

This invention relates to finish removers and relates especially to removers having antiseptic or germicide properties and preferably comprising non-volatile antiseptic agents.

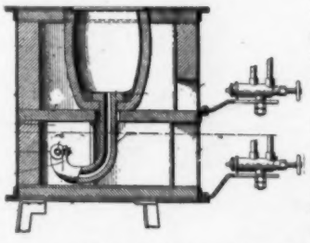
Two of the claims covering this compound are:

1. The finish remover comprising approximately benzol 40 parts, denatured alcohol 35 parts, boric acid 3 parts, benzoic acid 4 parts and ceresin 1 part.

2. The finish remover comprising approximately benzol 40 parts, denatured alcohol 35 parts, boric acid 3 parts, benzoic acid 4 parts and waxy stiffening material.

1,049,314. December 31, 1912. **Apparatus for Atomizing Metals.** J. M. Neil, New York, N. Y.

The particular object of the present invention is to produce an apparatus, as shown in cut, which will be especially adapted for successfully atomizing zinc; while also capable of use for atomizing other metals; and its subsidiary object is to simplify the construction of my prior apparatus while enhancing its efficiency. By this apparatus it is possible to obtain metals in an extremely fine state of subdivision, but unoxidized, and in such physical condition that even on exposure to ordinary atmospheric condition they remain unoxidized; and metals in this condition are termed "atomized." Such atomized metals are especially adapted for use in recovering precious metals from cyanid solutions obtained during the treatment of ores by cyanid.



Operation: The molten metal from the crucible descends through the tube and exudes upwardly through the aperture onto the top of the atomizer head; and the exuding molten metal is flattened out upon the surface of the head in a thin sheet or film and then immediately thrown off the head and dissipated in atomized condition by the jet of heated fluid forcibly issuing from the aperture in the head. The metal is thus instantaneously reduced to a fine, almost impalpable powder. Suitable means should be provided for catching and collecting such atomized metal.

1,049,799. January 7, 1913. **Composition for Constructing Molds, Cores and the Like for Use in Casting.** J. W. Bainbridge, London, England.

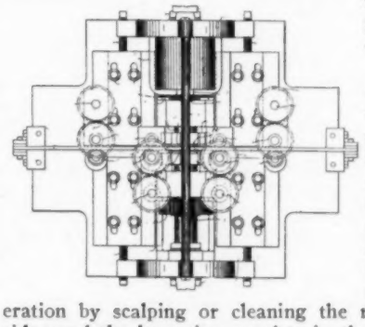
This invention relates to an improved composition for constructing molds, cores and the like for use in casting and consists in incorporating with a mixture of new, and used or burnt sand, a thin paste or thick cream comprising linseed or like meal, molasses and water, to which is added camphor. It has been found that the employment in the manufacture of molds of camphor with the other ingredients as stated, enables the metal to lie better and reduces the proportion of blow holes and faulty castings. Suitable proportions of the ingredients consist of linseed meal equal to from ½ to 5 per cent. of the weight of the sand to be treated, molasses of ⅛ to ¼ per cent. of the weight of the sand to be treated, and a small quantity of camphor, say about 1 to 3 per cent. of the weight of the sand.

The molding sand can also be prepared in the following manner: The molding sand is mixed in the usual way, the composition of linseed meal, molasses and camphor is then added, and the whole incorporated, after which the mass is moistened with water and treated in the usual way.

It is sometimes an advantage to mix coal-dust with the sand before adding the thick, cream-like composition before mentioned, if the molding sand is intended to be used for a so-called wet casting.

1,051,084. January 21, 1913. **Machine for Overhauling Metal.** James M. Chatfield and K. W. Holden, Thomaston, Conn.

This invention relates to an improvement in machines for overhauling flat metal plates, that is, for removing the scale or oxidation from plates of brass after they come from a rolling mill. Machines for this purpose are sometimes called scalping machines.



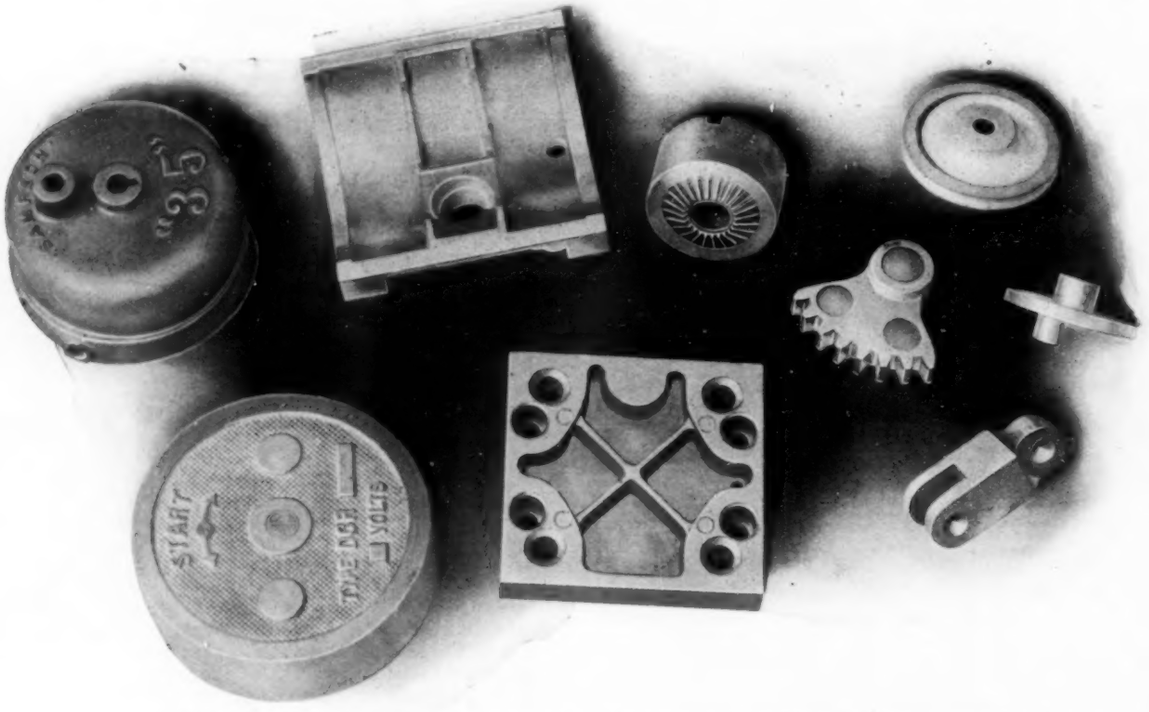
The object of this invention is to provide means for supporting the plates on one edge and for scalping the entire surface of one or both sides of a strip of metal at one operation rather than to scalp or trim a portion of one surface and then subsequently complete the operation by scalping or cleaning the remaining surface of that side; and the invention consists in the method and construction as shown in the cut.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

DIE CASTINGS AND MOLDED METAL PARTS

The Doehler Die Casting Company, Brooklyn, N. Y., have just announced their latest achievement in the art of die casting. These castings are, as will be seen from the accompanying illustration, Fig. 1, made of aluminum and are stated by the makers to be of the same high quality as to workmanship and material as their die castings in copper, brass and white metal alloys. Furthermore these aluminum die castings are claimed to be superior to the ordinary aluminum castings, made from sand molds, in finish, strength, accuracy and reliability, and under these heads the Doehler people give the following reasons:



SOME ALUMINUM DIE CASTINGS MADE BY THE DOEHLER DIE CASTING COMPANY, BROOKLYN, N. Y.

FINISH: Because they are smooth, with sharp outlines and all holes cast.

STRENGTH: Because they are cast under pressure, producing a closer grained and tougher metal. The tensile strength is greatly increased by the quick chilling process to which the parts are subjected in the metal molds.

ACCURACY: Because they require no further machining except where very close dimensions are necessary.

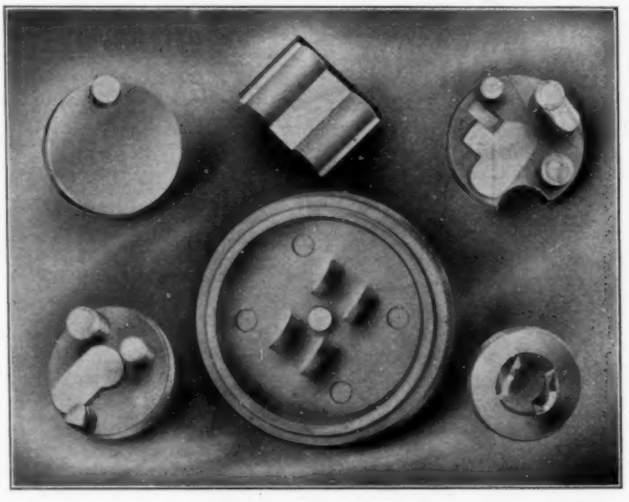
RELIABILITY: Because they are homogeneous and of uniform strength.

In addition to the interesting line of aluminum die castings described above the Doehler company has finally succeeded in producing what they term "brass molded parts," and these are castings made of brass, but pressed hot while in a plastic condition in a mold which has been carefully machined to size. Some of these castings are shown in the illustration, Fig. 2, and the Doehler company have the following to say about them:

As the name indicates, these "brass parts" are produced in molds which give them a smooth finish and comparatively close accuracy.

The parts manufactured by them are accurate reproductions of the pieces as they are delivered by the mold. They are ready for assembling and require no further machining except where close dimensions are necessary.

They can hold dimensions, generally speaking, within .002 inches to .005 inches depending on the general construction of the part. Where closer dimensions are required the part must



SOME BRASS MOLDED PARTS AND A MOLDED COPPER ELECTRICAL CONTACT PART.

be machined. They prefer to take up the question of accuracy with reference to the particular requirements in each case.

By reason of the enormous pressure, 20 tons to a square inch, to which the parts are subjected they become absolutely homogeneous and free from all possible casting defects, consequently having greater strength and tenacity than brass castings.

The alloy used is high in copper, golden yellow in color and easily machined. It shows a tensile strength of approximately 55,000 pounds per square inch, an elastic limit of about 40 per cent. of the ultimate tensile strength and an elongation in six inches of about 20 per cent. They state that they cannot work to special formula as their process requires a metal of certain qualities to get the best results.

For each part a series of molds is constructed which are not costly in comparison to the saving they make possible in the cost of production of the part. The cost of constructing the molds is charged to the customer, but the molds remain in possession of the company and are kept by them in good working condition for future use. They will, of course, not be used for anyone else.

For the present they are confining themselves to small parts weighing a pound or less and not exceeding three inches in overall dimensions. They do not form holes, slots or threads, but the parts are delivered as a solid piece with holes spotted only, excepting such parts which may be perforated by a punching operation.

PNEUMATIC SPRAYERS

The Eureka Pneumatic Spray Company, 276 Spring street, New York City, who claim to be the originators of sprayers and process of finishing all manner of goods by compressed

THE EUREKA LOW PRESSURE SPRAYER. MODEL 13.

air, have added a new model to their line shown in cut, which embodies all of the good points of the old models of Eureka Sprayer, as well as new and valuable features. The construction of the Eureka line of sprayers is entirely of brass; no tin, iron, steel or other metals being used in their construction. The pots are of seamless brass, tin lined, and attached to the upper part of the sprayer by means of a coarse thread such as is used on ordinary fruit jars; this means that the air and fluid tips are always in permanent and fixed alignment, and that there is nothing in the pot to prevent easy access for cleaning purposes. The sprayers are also lighter than the old original model, and all of the Eureka sprayers are now made to operate under low pressure.

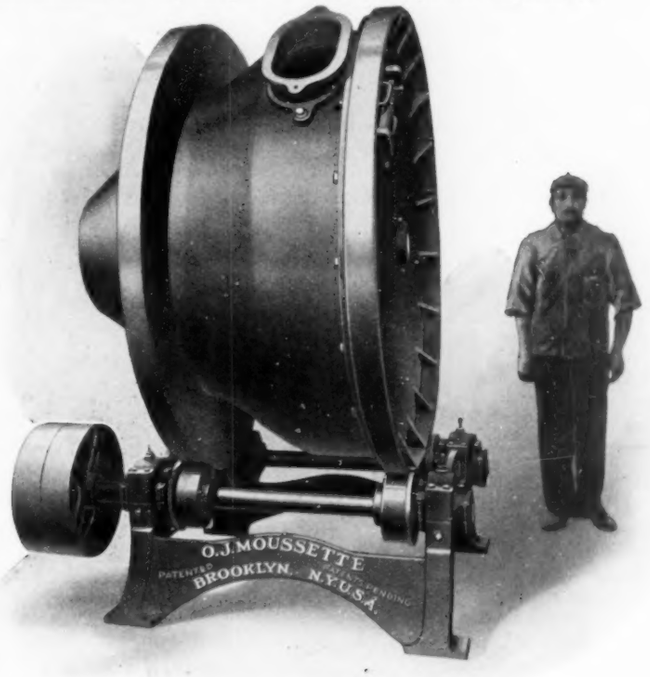
The present line of Eureka sprayers, it is said, will work at a lower pressure than any other make and work better; and not only that, but they will not use more than one-quarter or one-third the amount of air that other so-called low pressure sprayers consume. This means that manufacturers do not have to buy so large an air compressor, nor use so much power in compressing the necessary volume of air. The Eureka line is, in addition, claimed to be much lighter than any other make of sprayer, and contain no pressure in the pot; they operate on the siphon principle, mixing the air with the liquid externally and permitting of external adjustment without any difficulty or loss of time; and since the air and the liquid is mixed externally, it does away with the troubles of other makes which mix these materials inside, and thereby clog up.

The Eureka Pneumatic Spray Company also announce that within the next two weeks an additional model of sprayer of the Pistol type with needle control of fluid will be offered to the public. This will permit of overhead tank of any capacity; the sprayer is practically the same as the present Eureka sprayer, with the exception of the additional valve for controlling flow of fluid through the fluid pipe. It will be much lighter than any other make as well as much stronger and simpler, and will be offered at a considerably lower price. New catalog on request.

NEW ROTARY MIXER

A new mixer has been brought out for mixing residual material containing gold, silver and platinum. This mixer as shown in the cut is claimed by the manufacturer to be the only successful mixer for this purpose ever manufactured. All smelters and refiners still resort to the old method of mixing their batches with shovels—requiring the work of three or four men from five to eight hours' time, while this rotary mixer, it is said, will mix a batch thoroughly in from one half to one hour.

These mixers are made in different sizes to hold up to 10 and 12 tons of material at one time. The machine is hermetically sealed, which does away with the necessity of dampening the pulverized material. The process of filling and emptying the machine is very simple. The greatest power required to



THE MOUSSETTE MIXER FOR METALLIC RESIDUES.

operate the largest machine is 2 h. p., and for smaller machines in proportion. The machines are made by O. J. Moussette Company, Inc., Brooklyn, N. Y., sole patentees and manufacturers.

CAPITAL DUCTILE GUN METAL

Edgar T. Ward & Sons, Boston, Mass., are the sole selling agents for a new gun metal alloy made in Sheffield, England. They say of this material:

Capital ductile gun metal is a perfect alloy of pure copper and tin, combined by a secret process, positively without any other element. Reference to standard text books shows it to have been generally believed that such a combination was impossible without the use of iron, zinc or some other agent. It was be-

lieved that these agents were necessary to assure malleability and ductility of the alloy. The value of this discovery is increased when the fact is considered not only can the alloy be made but it can be manufactured in large quantities for commercial use with absolute uniformity of product. The remarkable homogeneity of this alloy in any shape readily adapting it for machine work, drawing and forming, as well as casting, cannot fail to warrant its adoption in many fields new to copper and its alloys. All gun metals, bronzes, and similar alloys while resisting corrosion much longer than certain pure elements still contain some element which through electrical or chemical action finally corrodes the alloy. We claim positive resistance of corrosion in exacting uses for Capital gun metal, because it contains absolutely nothing but copper and tin.

Capital gun metal fulfills its adaptability for many machinery uses by its high tensile strength, a feature uncommon in copper alloys. Bearings, high pressure valves, screens, springs and rims for use on expensive and intricate machinery, high duty engines, etc., require great strength, durability and uniformity of results under uniform stresses. The purity of combined elements together with the fact that the manufacture of this alloy is no longer an experiment but is proceeding with accuracy in every operation, warrants our guarantee of the high tensile strength shown by several tests. Moreover, this strength assures reliable springs under difficult conditions of high heat, carbonic acid gas, etc., and makes enduring springs of high frequency.

With the ingredients of bronze (which can only be cast and not machined), Capital gun metal is ductile and malleable. It can be threaded, formed, drawn, rolled, and milled easily and with only the reasonable precaution against foreign strains, in general machine shop practice. Castings are sound and perfect with a lower percentage of wastage than has heretofore been possible with similar alloys.

The manufacture of buckles, plate, ornaments and cheap jewelry in imitation of gold depend upon these qualities as well as the remarkable similarity of color and polish to gold.

OPTIMUS PLASTIC ALLOY

It is frequently supposed that copper surfaces are smooth and regular. However, this is not true, as is shown by Fig. 1, which shows a copper plate ground and polished to the highest degree, slightly magnified. This micro-photograph shows hundreds of mountain peaks and deep, irregular valleys, and not even a single level ridge. Now, if we put two bars like this face to face, they

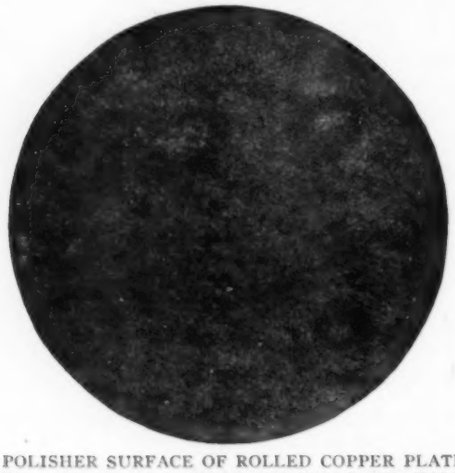


FIG. 1. POLISHER SURFACE OF ROLLED COPPER PLATE. MAGNIFIED 50 DIAMETERS. NOTE THE HILLS AND VALLEYS WHICH PREVENT PERFECT ELECTRICAL CONTACTS.

can touch each other only at the high points, and the current, instead of having the entire cross section of the surface of contact as a path, has to concentrate at the few peaks which touch, consequently making the contact resistance very high. Even though we put considerable pressure on the joint, the valleys are not forced into contact and moisture creeps in, fills them up with a non-conducting oxide, which serves to bring in more and more moisture until the mountain peaks themselves are covered.

Fig. 2 shows a polished surface on the edge of a copper plug under heavy pressure into a cylindrical hole in a steel rail. The dark line shows the oxide layer, and the contact resistance is high, though when examined with the naked eye the surface seems perfectly bright. Now it is evident that if we had some kind of putty, which is a good conductor of electricity, we could use it for filling up the valleys and get practically a perfect contact. Then if we could put into the putty a liquid metal, which would fill it as water fills snow, we would get even better results, and if this

FIG. 2. LINE OF CONTACT BETWEEN STEEL RAIL AND COPPER TERMINAL OF COMPRESSED TERMINAL BOND. MAGNIFIED 50 DIAMETERS.

liquid would stick to the copper as tightly as does water when put between two glass plates, we would get even better conductivity, since the force of adhesion is very great when acting at close range.

"Optimus" plastic alloy is said to be just such a metal putty, and just such a liquid metal is released from the solid alloy which is used to chemically prepare the copper surfaces and to hold the metal paste in the valleys. These alloys adhere so tightly that there is practically no contact resistance left, and the two copper plates are electrically continuous. Moisture cannot get into the joints and the putty will not corrode. It is customary to allow one square inch of copper contact surface to 50 amperes in bus bars, switches, ammeter shunts, etc. But with Optimus plastic alloys, one thousand amperes per square inch can be allowed at the joint with practically no more losses than occur in a solid conductor of the same cross section, and furthermore, if the contacts are properly prepared, they will remain perfect for years. "Optimus" plastic alloy is manufactured by the Munning-Loeb Company, of Matawan, N. J., who have made tests in electroplating operations showing conclusively that it pays to make joints in electric circuits with as low a resistance as possible.

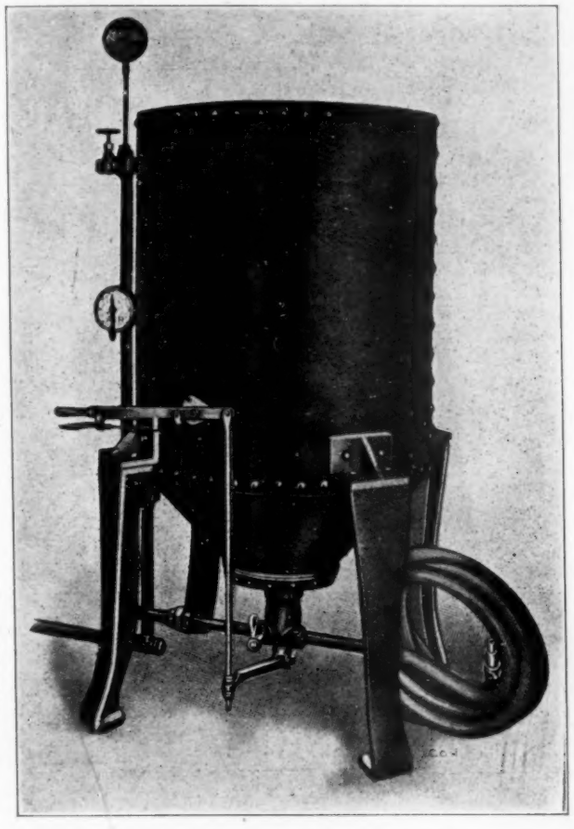
MODERN SAND BLAST MACHINE

The sand blast machine shown in the cut has been especially designed to meet the extreme range of work demanded by modern requirements from the intense cutting action necessary for the cleaning of steel castings to the very light action essential for matting soft metals and frosting glass and fixtures. The simplicity of this machine is self apparent. All the mechanism or working parts are located outside of the tank and there is nothing which will suffer through wear and tear and require repairing. Every part which needs attention is easily accessible and a few directions from the foundry foreman will enable an unskilled man to operate the machine.

It is claimed that wet sand will cause less trouble with this machine than with any other design because the air is blown through the carburetor and hose before the sand is used. Air without sand can be blown through the machine for the purpose of cleaning away dirt by merely closing the sand valve lever and turning the handle on the 3-way valve so that it will read "straight air." In this way the air is not passed through the tank.

The uses of this sand blast machine are many and varied; the

principal one of which, however, offers an extremely wide field, namely, in the foundry where silver, brass, aluminum and hardware can be given a frosted or matted finish, to say nothing of the ordinary cleaning of rough castings. Metal joints can be more quickly and properly cleaned for brazing or electric welding. Chandeliers, automobiles, etc., can be treated by the sand blast to great advantage.



THE MOTT SAND BLAST MACHINE.

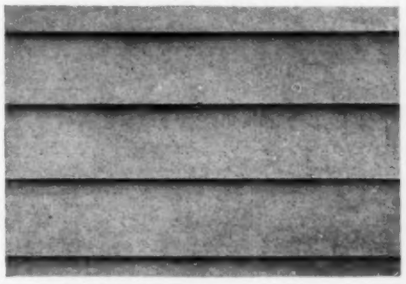
This machine is manufactured by the Mott Sand Blast Department of the De La Vergne Machine Company, E. 138th street, New York.

A CURE FOR BREAKING CORES

AN INTERESTING OFFER IN THE FOUNDRY WORLD.

Linseed oil, as everyone knows, is the basis of all paint and varnish. Many people don't know that it is also the basis of lithographic inks, that it is mixed with cork to make linoleum, that it makes oilcloth and insulated conduits and that it gives the shine to patent leather and rubber. The oil has always fluctuated in price, the market being largely determined by the Duluth Flaxseed Exchange and other seed depots. It has averaged about fifty cents a gallon. Not long ago, however, it sold for over double that amount. With such a useful and such an expensive oil it is only natural that adulteration should take place. It is only natural according to Human Nature, however, and not according to Mother Nature. Adulteration kills the very properties that make linseed oil so valuable.

PAINT MADE FROM ADULTERATED LINSEED OIL.

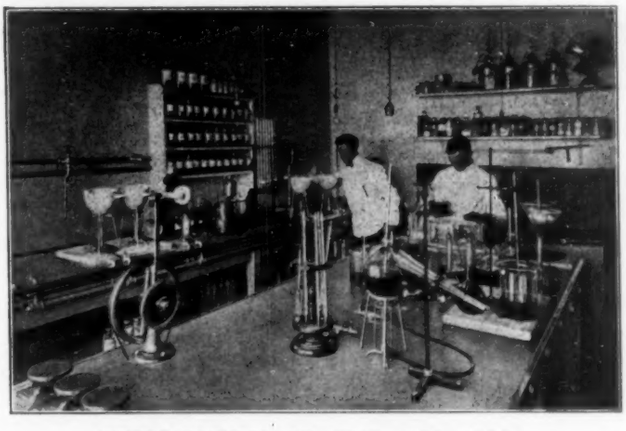


PAINT MADE FROM PURE LINSEED OIL.

It is to detect these harmful adulterations that Spencer Kellogg and Sons, Inc., Buffalo, N. Y., the largest producers of linseed oil in America, maintain their free laboratories. For years their chemists have analyzed free of charge any sample of suspected linseed oil submitted to them. This has been a very powerful factor in protecting ingenuous or credulous purchasers. Of course, being primarily of importance to the hardware and paint trade, this free analysis has been limited to users of linseed oil.

It is now announced, and on good authority, that they are to open their laboratory to the foundry trade as well. Keen students of foundry conditions are realizing what an essential factor the core is in the production of a casting and how vital it is to success that the core oil used be absolutely uniform. Broken cores are due to a structural change in the oil in nine cases out of ten.

It is here that the foundries will undoubtedly make use of the Kellogg laboratories. If there is any question as to the uniformity of the core oil being used, if one barrel acts differently from another, the scientific tests made free of charge by Spencer Kellogg and Sons, Inc., of Buffalo, N. Y., will quickly bring the matter to light and put an end to guess-work.



WHERE FOUNDRY OIL TESTS ARE MADE.

Breaking cores are one of the petty annoyances of foundry work that bring premature gray hairs, and it is mostly needless and wasteful. Since they make Gold Bond foundry oil, Spencer Kellogg and Sons, Inc., will undoubtedly be called upon to test some of their own products, and it will be interesting to read their reports. It is believed that many of the foundry trade will take advantage of this unique offer, as many in the paint trade have already done.

HOW TO USE PROMETHEUS SALTS

The following directions are given for the preparation of Prometheus nickel plating baths:

Dissolve Prometheus in hot water and use two pounds for each gallon of solution. The cooled solution is ready for use and must possess a specific gravity of about 16 Baumé. Use 2½ to 3½ volts, with a current of from 8 to 10 amperes to the square foot. Anodes should be cast and 98 per cent. pure nickel. However, it is admitted that nearly all platers, with the exception of a few of the very largest who have already adopted the salt, are using lower percentage anodes, 90 to 92 per cent., with marked success, but all the leading manufacturers abroad are using 98 per cent.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

ELECTRO-PLATERS' ASSOCIATION

President, Richard H. Sliter, Jersey City, N. J.; Recording Secretary, A. J. Stremel, Brooklyn, N. Y. All correspondence should be addressed to the Secretary-Treasurer, Royal F. Clark, 246 Fulton avenue, Jersey City, N. J. This is an educational society, the objects of which are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. Meets at Grand Opera House Building, 309 W. 23rd street, New York, on the fourth Friday of each month, 8 p. m.

Thirty-five members attended the regular monthly meeting held January 24. Two applications for active and one for associate membership were acted upon favorably. The chief speaker of the evening was George B. Hogaboom, who gave an interesting description of a simple method of removing carbonate of potash from a silver bath, dilating upon the effects of this salt upon the deposit, the density of the solution, the voltage, etc.

The annual banquet of the association will be held at the Broadway Central Hotel, New York, on Friday, February 21. A parlor will be open all day for members and guests, where samples of various finishes executed by the members will be on exhibition. The committee reports that among others, the following speakers are expected: Dr. J. W. Richards, Lehigh University; Dr. George F. Kunz, Tiffany Company; H. B. Coho, United Lead Company; Dr. Wm. App Jones, of the Celluloid Zapon Company, New York, will be toastmaster. Tickets are $1.50, and may be purchased from members or the secretary. On Saturday morning a delegation will visit the experimental plating department of the Hanson & Van Winkle Company at Newark, N. J.

At the January meeting of the Philadelphia branch two new members were elected and two applications received. Through the generosity of the Hartford Silver Company, a meeting will be held at their plant on February 14, for experimental purposes. J. Lawrence McBride will speak on Electro-Chemistry.

PERSONALS

ITEMS OF INTEREST TO THE INDIVIDUAL.

GEORGE M. LANDERS

Pride in the men who have helped to make New Britain, Conn., what it is, is one of the chief characteristics of the residents of the Hardware City, as it is called, and foremost among the manufacturers stands George M. Landers, who has distinguished himself by his executive ability, business acumen and energy. For a young man Mr. Landers has made rapid strides and has helped to place New Britain on the map in many ways.

GEORGE M. LANDERS.

Mr. Landers received his knowledge of the manufacturing business as a natural inheritance. His grandfather, George M. Landers, Sr., was the senior member of Landers, Frary & Clark, and was regarded as the moving spirit in the development of that giant corporation. At his death his son, Charles S. Landers, came into prominence and occupied the position of secretary and treasurer of that firm, held by his father. The position was handed down to his son, George M., when Charles S. died.

As an official of Landers, Frary & Clark, George M. Landers displayed a wonderful grasp of business affairs, and although it had not been long since his graduation from Yale (having been graduated from that university with the class of 1891), he plunged into a study of the executive end of the corporation and had soon mastered its many intricate points. He remained in activity with Landers, Frary & Clark until about two years ago, when he married, and thereafter spent much of his time in New London. He resigned his office with Landers, Frary & Clark and opened an office at the factory of North & Judd, of which he had been president for a number of years. He still retains an interest in Landers, Frary & Clark and is today a heavy stockholder in that concern. Mr. Landers is financially interested in other local industries and is a director of Humason & Beckley, which was recently sold to Landers, Frary & Clark and which was later reorganized as a separate concern.

Aside from his business interests, Mr. Landers has found time to devote towards the welfare of the city along other lines, and in this connection he has served as mayor twice and as city councilman, once representing both Republican and Democratic parties. Last fall he was the choice of the people for state senator from the Sixth district of Connecticut, and in the short time he has spent in the General Assembly he has demonstrated his wisdom and sagacity on many occasions. He is president pro tem of the Senate, and in the event of Governor Baldwin being appointed to the cabinet of President-elect Wilson, Mr. Landers will become lieutenant-governor of Connecticut.

Hugh McPhee, former secretary of the Associated Foundry Foremen's Association, and proprietor of the Tarrytown Aluminum Bronze Company, Tarrytown, N. Y., met with a painful accident in his foundry January 30. Mr. McPhee was struck in the face, neck and arms by molten aluminum and severely burned. The latest report states that while the sight of his left eye was destroyed that of the right is saved and he is now resting comfortably.

C. H. Winslow, formerly employed in the foundry of Factory "L" of the International Silver Company, Wallingford, Conn., is now connected with Foster, Merriam & Company, Meriden, Conn. Albert Underwood, who was formerly under Mr. Winslow's direction, has succeeded him.

DEATHS

Peter Colgan, President of the New Haven Button Company, Inc., New Haven, Conn., died on December 16, 1912.

Charles C. Miller, a wealthy brass manufacturer, died at his home in Indianapolis, Ind., on December 28, at the age of fifty-three.

After an illness of only two days with asthma, James A. Bradford, proprietor of the Charlotte Brass Works, died at his home in Charlotte, N. C., on January 26. Mr. Bradford was forty-seven years old and is survived by his wife and one son.

Henry J. LaMarche, an importer of metals, died suddenly at his home, 55 East Sixty-fifth street, New York City, on January 31, at the age of fifty-seven. Mr. LaMarche was born in Belgium but came to the United States at an early age. He was a member of the University and the New York Athletic Clubs.

Trade News

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS AND TRADE ITEMS OF INTEREST FROM THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

FEBRUARY 3, 1913.

Good news prevails among the factories engaged in the metal industries hereabouts and the prospects, even among the most conservative are considered good. There is plenty of business in all plants and while the orders coming in are not large, there is no cessation of new ones. The steady demand indicates that many lines have been allowed to run out among jobbers and retailers and present orders are for the purpose of replenishing low stocks. As practically every line is affected the prosperity born of such conditions is general. With the approach of March, the older heads look for a slight falling off, for this is usual at this season, but it would not be surprising if they were disappointed about the size of this decrease, and pleasantly so.

During the month of January there has been considerable sociability. Foremen's associations, dances of employees and similar social affairs have been held, and it is characteristic of these to cement more firmly the general good feeling between employees and employers. These gatherings of employees, for their own amusement, are fostered largely by the generous attitude of the corporations towards them and are considerably embellished by the financial aid that the companies extend in one way or another. Among the important events of this nature was the gathering recently of the foremen's association of the Scovill Manufacturing Company, at which the pleasing announcement was made that the company had taken steps to provide an ideal clubhouse for the association. Another jollification along these lines was the annual banquet of the foremen's association of the Plume & Atwood Manufacturing Company, which was the first foremen's organization formed hereabouts and which has done much to establish the good fellowship and commendable spirit that exists throughout the entire working force. Still another affair, one of those which is awaited with delight from year to year, because of the opportunity given to the public to participate, was the annual dance and minstrel show of the Waterbury Clock Company.

One of the important events of the past month was the passing of the Waterbury Business Men's Association into a Chamber of Commerce. It has been the hope and desire of prominent citizens for a long time that this might be accomplished, but various obstacles have opposed until now. Its constitution has been amended, its name changed and its membership is undergoing a radical improvement. Charles A. Colley, a prominent real estate owner, has been made president of the new Chamber of Commerce and has been greatly encouraged in the upbuilding of the new organization by the applications for membership which he has received from leading manufacturers. Before the February meeting, at which the temporary organization will be completed, it is expected that practically all the larger manufacturing concerns in Waterbury will be represented by the names of applicants for membership. If this expectation is realized the success of the chamber will be regarded as assured, for the lack of interest in the business men's association is considered mainly responsible for its decadence as a force in the community.

Building goes on, although not as extensively pushed as some months ago, but with vim enough to confirm the generally prosperous tone of the manufacturing community. In the west end another big addition to the plant of the Waterbury Brass Company branch of the American Brass Company is towering over the structures around it, its steel frame work eloquent of the permanence of its design and the uses it will be put to. Opposite the depot the new office building of the American Brass Company is rising rapidly, the masons having already completed the outer walls of the basement and first story, and enough of the general design appearing to promise a structure of strength and attractive appearance. In Waterville the Chase Rolling Mills Company's tube-making plant is rapidly nearing completion. The trolley line of the company from Waterville to its old plants on North Main street, which cuts across the town, is almost completed and a large electric locomotive, very similar to those in use on the New York Central and New Haven railroads over their electrified sections, has been operating on the road nearly a week. The opening of this plant, with the operation of this trolley line starting simultaneously, is expected to cause considerable shifting of the population and a considerable boom in real estate and building throughout the western portion of the city.

In the towns outside of Waterbury practically the same conditions are found as here. In Thomaston the Plume & Atwood Company's mill is running well and the early-in-the-year lull at the plant of the Seth Thomas Clock Company is being left behind. This company lacks none of the general prosperity, having had large orders for its goods, particularly watches, all through the fall, assuring it of steady going practically all of this year. Torrington is busy and promises to be for some time in practically all its shops, and in Winsted no fairy tales are needed to keep its industries on the map. South of this city the metal industries are thriving, notably in Seymour and Ansonia, where practically all those in the copper, brass and alloy goods branches are running steadily and report good orders and good prospects.

Tariff legislation has paled considerably, if indeed it could be considered of great importance among the conditions affecting business hereabouts during the past six months, but the fact that it is not openly discussed does not mean that it is not taken into account. George A. Driggs, president of the American Pin Company, returned from Washington about the middle of the month, after filing a brief protesting against the proposed schedule of rates on hooks and eyes, in lieu of a personal appearance before the committee, although he had waited there for several days. He gave out an interview here saying that if the rates on hooks and eyes proposed in the Underwood bill were made effective, American manufacturers would be seriously handicapped. His company, he says, has made arrangements with an English concern to manufacture and import its goods, as it can import them under the Underwood bill cheaper than it can manufacture them in competition with the foreign manufacturers. Such a step as this will affect some 3,000 employees of the company. The name of the company in England was not disclosed by Mr. Driggs. All the interests hereabouts are watching the developments tariff-wise and may be depended upon to look after their industries carefully, as well as to so rearrange their business in the event of hostile tariff legislation to meet the changes as to render them least harmful. Meantime they are hoping for sane legislation in this direction under the incoming administration.—F. B. F.

PROVIDENCE, R. I.

FEBRUARY 3, 1913.

Notwithstanding the uncertainty and apprehension that the manufacturers of the various metal industries in this vicinity entertain as regards the outcome of the tariff agitations, the business conditions at the close of the initial month of the new year appear to indicate a continuance of generally prosperous times. With the manufacturing jewelers, who constitute a very large percentage of the metal industries of this section, there is a very decided optimism that promises well for the business of the year. The early buying by the unusually large contingent of buyers that visited this city was followed by good orders to the travelling men on the initial trips through the west, and the result is that all the shops, while not rushing to limit of capacity are doing a normal steady business that is appreciated by the employer and employee. It is expected by a majority of the manufacturers that there will be reductions made in the tariff, but the principal interest appears to be concerned in the sundry paragraph of the metal schedule rather than in the regular jewelry schedule, as it is there that the most controversy is experienced and in connection with which the majority of the protests and contests are made.

The amount involved in failures among jewelry jobbers in this country and Canada during 1912 was $800,000 less than during the previous year, according to the annual report submitted by Manager Horace M. Peck at the annual meeting of the Manufacturing Jewelers' Board of Trade on January 25. Mr. Peck gave a list of the failures for three years past and also made interesting comment on the work being done and urged a bigger fund for new prosecutions of fraudulent failures. The meeting was well attended by members from Providence and the Attleboros, and in opening the session President Frederick D. Carr spoke of the progress made by the organization during the past year, calling special attention to the saving to members through the board's method of handling failure matters in various parts of the country. Reports of the manager, secretary, auditing committee, executive committee and trustees were presented and showed the organization to be in a satisfactory condition. Upon the adjournment of the annual meeting the newly-elected board of directors convened and unanimously elected the following officers: President, Frederick D. Carr; Vice-Presidents, Charles A. Russell and C. J. McClatchey; Secretary and Treasurer, Marcus W. Morton; Manager, Horace M. Peck; Executive Committee, Frederick D. Carr, Everett L. Spencer and Alfred K. Potter. Auditing Committee, C. J. McClatchey, L. H. Bosworth and Edward B. Hough.

The Cadwell Manufacturing Company of Cranston has changed its name to the Atlantic Tubing Company. James Peacock, John Pyper Peacock and Samuel W. Bridgham are the incorporators of the firm of Peacock & Sons, manufacturing jewelers, which received a charter recently. The capitalization is $35,000, and the company will locate in this city. A final dividend of 75 per cent. has been declared in the matter of the Pawtucket Foundry Company of Pawtucket. This makes a total dividend of 1.75 per cent. The Strauss Company, sheet tin, etc., has removed from 303 Eddy street to 370 Richmond street.

The National Association of Manufacturing Jewelers is completing plans for the entertainment of the members of the National Association of Wholesale Jewelers, when the latter holds its annual convention in this city in April. Harold E. Sweet, secretary of the Manufacturers' Association, has been in communication with members for the purpose of discussing plans and at a meeting recently held in this city arrangements were discussed and committees appointed.

The Hope Foundry Company, of Warren, has been granted a ten years' tax exemption on a little over two acres of land, by the Cranston City Council. The property is on Elmwood avenue, in the village of Auburn, and the company agrees to build a $25,000 building and install at least $5,000 worth of machinery within a year. The company is also going to build several houses on a piece of land adjoining its plant. Employees to the number of sixty are on the payroll of the foundry at Warren, but the management contemplates employing 200 hands in the new factory. The concern is an adjunct to the Standard Machinery Company, which is already building at Auburn.

The annual winter banquet of the Rhode Island Branch of the National Metal Trades Association was held at the Narragansett Hotel on January 24, at which time the principal speakers were Henry D. Sharpe, of the Brown & Sharpe Manufacturing Company of this city, and Judge William H. Spear of the United States Circuit Court of New Jersey. The first speaker after the dinner was Mr. Sharpe, who addressed the local branch for the first time since his election as President of the National Association. After thanking the branch for its part in the matter, Mr. Sharpe spoke briefly on conditions in the metal trades. The present labor situation in the industry, he said, was very peaceful, and both employees and employers were making greater efforts to understand each other. Wages were constantly on the increase, he asserted, and the workmen were appreciative of the employers' efforts in that direction. Mr. Sharpe was followed by H. I. Illingworth, of Boston, President of the Boston Branch of the association. He asserted that the attitude of the Metal Trades Association was a decided advantage to the workmen, and that employees in the industry were content, which was a valuable asset to the employers.—W. H. M.

ATTLEBORO, MASS.

FEBRUARY 3, 1913.

The month opens with the jewelry trade anxiously waiting an inspection of the new tariff bill that will be drawn by the time the new Democratic congress makes its appearance. It seems settled from the state elections of senators that the Democrats will have control of the senate, with three or four Progressives perhaps holding the balance of power. It is a situation extremely difficult to forecast, and much depends on the tariff as it comes from committee since it is not believed that many changes will be allowed. The jewelers have focused their attention upon removing their industry from the metal schedule. Jewelry is now taxed under that and under the sundries schedule. It is felt that the metal schedule is due for a sharp cut, much like that the metal schedule in the last congress would have administered, and it is desired that jewelry be taken from that paragraph and treated wholly under sundries, where there is a better chance of it being treated as the luxury it is, deserving of protection.

February opens with a variety of reports. Some of the firms are rushing and announcements come through the daily press of 13-hour schedules. Other shops report business dull. The salesmen coming in report a fair but very cautious trade. The staple lines seem to be booming.

A certificate of incorporation has been granted the Balfour company of Attleboro to manufacture jewelry. It has a capital stock of $50,000. Lloyd G. Balfour of Indianapolis is president, Ralph C. Thompson is treasurer and Ralph E. Estes is clerk.

The jewelry trade school proposition was flatly turned down by the State Board of Education which was required to report on it last month. The state board indicates that an extension of the schools now in progress in North Attleboro and Taunton would be an advantage, but does not approve of a state-aided school to serve the whole district.

During 1912 there were 13 failures among the jewelers of Rhode Island and the Attleboros. The assets were $33,456 and the liabilities $125,575.—C. W. D.

NEW BRITAIN, CONN.

FEBRUARY 3, 1913.

Business along metal manufacturing lines in New Britain has not been so swift to decline in volume as some of the manufacturers prophesied before the election. Orders are still coming in to all the concerns with usual steadiness, and there appears to be splendid prospects that conditions will continue, for a time at least, entirely satisfactory to the heads of the industrial concerns of the city. Without exception, metal manufacturing concerns report a January trade of better than average volume. The market for stock in local concerns is good. On February 1, Stanley Rule & Level stock, which always leads the New Britain list, was quoted at 395. Other quotations follow: American Hardware Corporation, 135½; Landers, Frary & Clark, 95; New Britain Machine, 61; Stanley Works, 56½.

With the far-sighted policy that has characterized the management of the American Hardware corporation since the organiza-

tion of the subsidiary companies into one large concern, plans for accommodating future growth have been undertaken, and already land has been purchased to provide for future needs. Plans are being prepared for factory additions to the P. & F. Corbin, Russell & Erwin and Corbin Screw Corporation plants, additions that will not be needed for years and may not be built for many months. One feature of this policy of making plans long in advance is said to be to permit foremen and superintendents to look them over and suggest alterations and improvements.

President Charles M. Jarvis and Vice President Isaac D. Russell, of the American Hardware Corporation, were in Washington during the past month, and appeared before the congressional ways and means committee in behalf of the metal ware manufacturers of New Britain. They were given a hearing, with other Connecticut industrial leaders, and also filed briefs. Their leading argument was to the effect that the industries of New Britain can stand only a very nominal cut in the manufactured metal goods tariff schedule.

The New Britain Machine Company has purchased from the American Hardware Corporation, the screw machine department of the Universal Machine Screw Company, Hartford, Conn. The American Hardware Corporation recently acquired this business. Its own works for the manufacture of screw machine products, those of the Corbin Screw Corporation, were unable to supply the demand, and the Universal Company not only builds multi-spindle automatic screw machines but conducts a large department for the manufacture of screw machine products. The Corbin Screw Corporation wished to produce immediately a large number of the Universal screw machines. Therefore the absorption of the business was wholly logical. The sale of the machine department carries with it a large order for machines, which will supplement the manufacturing capacity of the Hartford factory. The removal of the machine shop equipment to the New Britain Machine Company's works will release space for the screw machine products department. The New Britain Machine Company is building the automatic multi-spindle chucking machines which were acquired with the business of the George G. Prentice Company, New Haven, Conn., and the Universal screw machine is naturally a supplementary line.

Like a bolt from the blue came the announcement that Thomas J. Curtin had severed his connection with the Corbin Screw division of the American Hardware Corporation of which he was superintendent. Mr. Curtin had been with the company since 1876 and had worked his way from being a handy boy around the shop to the position of superintendent which he had occupied for about eight years. E. M. Pratt, who has been at the head of the finished products department, has been named as Mr. Curtin's successor. Mr. Curtin has made no plans for the future.

The Fafnir Bearing Company, of New Britain, has increased its capital stock from $100,000 to $300,000, while that of the Holmes Motor Company, Groton, Conn., has been increased from $80,000 to $130,000.

Work is nearing completion on a new factory building being erected at Plantsville by the Stanley Rule & Level Company to replace the buildings burned down three months ago. The new plant, in which the chisel manufacturing end of the concern's business is taken care of, will be ready for occupancy within a week or two at the most.

New Britain manufacturers have been more than pleased with their first experiments with the parcel post. Postmaster I. E. Hicks has taken a great deal of trouble to assist the factories in their tryout of the new innovation in postal affairs. The local factories use the parcel post mainly for samples and single packages of their goods. The concerns of the city are now sending out on an average of 600 pieces of this class of mail daily.—A. L. M.

BRIDGEPORT, CONN.

FEBRUARY 3, 1913.

The year 1913 has started out with very good prospects for this city, as relates to manufacturing industries, all of the shops having plenty of orders booked to keep them busy for many months. The value of the building permits issued for the month of January amounts to $293,485, or nearly four times the value of the permits issued for January, 1912. The La Resista Corset Company, in order to take care of its increasing business, is planning to replace its frame plant on Norman street with a larger structure of concrete blocks or brick.

The Crane Valve Company has a new $175,000 foundry building under way, and the new plant of the Connecticut Electrical Manufacturing Company on Central avenue is being hurried to completion. The Salt's Textile Manufacturing Company now has $29,000 worth of new buildings going up at its plant on Kossuth street. The Blue Ribbon Auto & Carriage Company is planning to build a handsome three-story brick plant to take care of its growing business. The structure will be located at the junction of State street and Fairfield avenue.

A "Made in Bridgeport" exposition of merchandise, manufactures, and food products, will be held in this city, March 31 to April 5, under the auspices of the United Commercial Travelers, Bridgeport Council.

Benjamin Briscoe, who has been one of the directors, also secretary of the Automobile Board of Trade since its inception, owing to his having left for Europe to be gone several months, has tendered his resignation, and the vacancies have been filled by electing John N. Willys, of the Willys-Overland Company, as a director and Roy D. Chapin, of the Hudson Motor Car Company, as secretary.

The American Graetzin Light Company, which is a branch of the Ehrich and Graetz company of Berlin, Germany, expects to soon begin the manufacture of lamps in a separate plant in this city. This company manufactures gas lamps, from the smallest light for interior use to the big giants that the company manufacture to light the streets of Berlin, Vienna, Paris, Moscow, and other European cities.

The Standard Manufacturing Company, manufacturers of automatic gear cutting, milling and slitting machines, announce that they have purchased the entire line of drilling and gear cutting machines of The Dwight Machine Company of Hartford, Conn. This includes not only the property of the Dwight Company, but also the name, right to manufacture, patents, etc. The manufacture of the Dwight line will be added to that of the well-known Standard machines.—F. A. B.

NEW YORK CITY

FEBRUARY 3, 1913.

Conditions in the metal and machinery markets of this city have been rather quiet during the past month though there is a feeling of confidence that sales during February will exceed those of a year ago. No very marked extensions of plants have been made, though most of the factories report a steady business. The present policy seems to be to let matters rest as they are until the tariff tinkering is finished. January, of course, is a good month with the manufacturing jewelers as the retailers begin to replace their depleted stocks after the holiday season.

The International Nickel Company state that the press report to the effect that they are planning to double the capacity of their plant at Copper Cliff, Ontario, is incorrect.

The New York Metal Exchange have issued their annual report, containing statistics of 1912. This report is compiled by C. Mayer, secretary of the exchange.

Thomas Maloney, formerly superintendent of Thomas J. Dunn & Company, of this city, manufacturers of metal novelties, badges, etc., has formed a new company under the name of The Thomas Maloney Company at 221 West Broadway, to manufacture a patented belt buckle.

The Superior Lamp Manufacturing Company has been formed by Harry Myer and Abraham Futterman at 124th street and First avenue, to manufacture lamps and horns for automobiles, also generators and metal stampings of all descriptions. These gentlemen have been in the automobile lamp manufacturing business for a number of years and are also operating the New York Coach & Auto Lamp Company, of 302 W. 53rd street.

The U. T. Hungerford Brass and Copper Company, Pearl and Park streets, will be forced to vacate their quarters in the near future as the city has purchased the building in which they are now located as part of the land for the new municipal park. The Hungerford company have therefore purchased the plot at 486 to

492 Pearl street, 93 by 125 feet, on which they will erect a twelve-story building, plans for which have been prepared.

The B. O. Bowers Company, Chemical Department, New York, sole licensees for America of Waldberg & Company, Paris, France, manufacturers of Persels plating salts and other electroplating supplies, have opened a new office and demonstration plant at 136 Liberty street, New York City, where Percy S. Brown will be in charge of sales as general manager.

THE NEW YORK AUTOMOBILE SHOW

The thirteenth National Automobile Show, held in the Grand Central Palace and Madison Square Garden, New York January 11 to 25, was the largest ever held in New York City, not only as to size, but also in regard to attendance and interest. The first week was devoted to pleasure cars and the second to commercial vehicles, with parts and accessories on display throughout the two weeks. The exhibits in both buildings were parallel in character. There were in all 702 displays housed. In the first week 42 makes of pleasure cars were shown in the Garden and 46 in the Grand Central Palace, the lowest priced car being one at $395 and the highest at $7,300. At the Palace 23 companies exhibited motor cycles. In the second week there were 25 displays of commercial vehicles in the Garden and 40 in the Palace. The estimated cost of all the exhibits was $5,500,000, and the estimated attendance 400,000. In both buildings the exposition space totaled 275,000 ft.

The exhibit of accessories and parts was extremely large and its interest was added to by novel arrangements of displays or ingenious devices for demonstration. Among the manufacturers showing their products were: Cleveland Hardware Company, Cleveland, Ohio; Coes Wrench Company, New York; Corbin Screw Corporation, New Britain, Conn.; William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.; Diamond Chain & Mfg. Company, Indianapolis, Ind.; Joseph Dixon Crucible Company, Jersey City, N. J.; General Electric Company, Schenectady, N. Y.; Globe Machine & Stamping Company, Cleveland, Ohio; B. F. Goodrich Company, Akron, Ohio; Hartford Machine Screw Company, Hartford, Conn.; Hyatt Roller Bearing Company, Harrison, N. J.; Ingersoll-Rand Company, New York; Janney, Steinmetz & Company, Philadelphia, Pa.; Frank Mossberg Company, Attleboro, Mass.; National Tube Company, Pittsburgh, Pa.; New Departure Mfg. Company, Bristol, Conn.; S. K. F. Ball Bearing Company, New York; F. W. Spacke Machine Company, Indianapolis, Ind.; Standard Roller Bearing Company, Newark, N. J.; Standard Welding Company, Cleveland, Ohio; Standard Thermometer Company, Philadelphia, Pa.; Veeder Mfg. Company, Hartford, Conn.; Wells Bros. Company, Greenfield, Mass.; Whitney Mfg. Company, Hartford, Conn.; J. H. Williams & Company, Brooklyn, N. Y.; Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

The idea of exhibiting machine tools crystallized too late to permit of the assembling of a large number of exhibits, and this feature of the truck show week was smaller than had been hoped for, but what was shown was excellently arranged and in most cases tools were demonstrated in actual operation. The exhibit occupied a section of the basement in Madison Square Garden. A 36-inch vertical turret lathe of the New Era type, was shown by the Bullard Machine Tool Company, Bridgeport, Conn. The Potter & Johnson Machine Company, Pawtucket, R. I., showed in operation two 6A. automatic chucking and turning machines, a 15-inch universal shaper and a No. 4 manufacturing lathe. The Garvin Machine Company, New York, had an exhibit of 24 tools, including a new automatic machine for cutting oil grooves in half boxes, solid boxes, bushings and bearing brackets. It cuts straight or spiral grooves, right or left hand, and is also applicable for key-seating. The Fairbanks Company, New York, exhibited a Fox No. 2 multiple spindle drill, manufactured by the Fox Machine Company, Grand Rapids, Mich., and Seneca Falls and Star lathes. The Lees-Bradner Company, Cleveland, Ohio, showed spiral gears, and the Cleveland Worm & Gear Company, Cleveland, exhibited worms of Ubas (Sheffield) steel and worm gears of phosphor bronze. The products are made on imported machines. The Baush Machine Tool Company, Springfield, Mass., showed a multiple spindle drill. Other exhibitors were the Hisey Wolf Machine Company, New York, and S. S. Eveland, Philadelphia, Pa.

PITTSBURGH, PA.

FEBRUARY 3, 1913.

Pittsburgh, the great industrial center of the Ohio valley, is growing fast and now has a population of over half a million. One reason for this rapid growth is the improvement which is taking place in the city; streets are being widened, the smoke nuisance has to some extent been abated, and the city as a whole has had a civic awakening; and this, of course, attracts new industries, and so there is a constant influx of labor.

The Anglo-American Gas Light Company of Seventh avenue and Smithfield street have purchased the Thomas Manufacturing Company's plant, making domes, portables and chandeliers. The Carnegie Hero Fund Commission awarded 12 bronze and 13 silver medals, out of 41 cases considered; pecuniary awards of $20,970 were disbursed. The Pittsburgh Brass Manufacturing Company of 3155 Penn avenue are busy with their brass castings and plumbing specialties.

The Thomas Gregory Galvanizing Company, of Brooklyn, N. Y., are locating a new plant here at Twenty-fourth street and the Allegheny Valley Railroad, to be known as the Hanlon-Gregory Galvanizing Company. The property has been purchased and a new factory building will be erected, to be 120 x 168 feet in size, and will employ 100 men at the start. The officers will be as follows: A. J. Diebold, of this city, president; Thomas M. Gregory, of Brooklyn, vice-president; William J. Gregory, of Brooklyn, secretary; A. J. Loeffler, of this city, treasurer; John A. Hanlon, formerly president of the Pittsburgh Galvanizing Company, will be general manager.

James & Edwards Bronze Works, of 3134 Penn avenue, have been in business three years and make all high tensile strength metals. They have opened a new pattern shop at Heron and Ridgway streets. J. P. Koehler & Company, of 2918 Penn avenue, smelters and refiners, mainly in copper, are looking for a new location for their plant, which would hold considerable more machinery.

The U. S. Manufacturing & Supply Company is a new firm at 434 Second avenue; A. J. Fisher, manager. They are making white metal and composition novelties. They also expect to put in a plant for brass castings. A. J. Fisher & Co., brass founders and electrotypers, went out of business at 434 Second avenue. George R. Kress Company, of 1900 Brighton Road, have started a brass foundry.

The Chaplin-Fulton Company, of Penn avenue, who make a specialty of manufacturing governors and meters and brass mountings, report business better than a year ago. They also make bells of copper and have their own brass foundry. The Penn Smelting Company are doing a fair business in smelting pig lead and silver.

The Keystone Bronze Company, of this city, elected the following officers: Montgomery Murray, president; W. H. Schoen, vice-president; George Best, secretary; John S. Craig, treasurer. They are doing a large business in brass, bronze and copper castings and operate the Keystone plant here and the new Brighton (Pa.) works. The plants are running full time and large improvements have been made to each plant. The Simmonds Manufacturing Company, of Chicago, manufacturing brass beds, has leased two floors, as warerooms, at Ninth and Liberty streets.

The Pittsburgh White Metal Company and the Rolled Plate Metal Company, of 508 Diamond Bank building, are making white bearing metals, which are governed in price by the ordinary changes in the price of lead, tin, antimony, etc. Their output is about as usual. The American Vanadium Company, of 332 Vanadium building, of Pittsburgh, have had plans drawn for a new plant to be erected at Bridgeville, Pa., which will treble the capacity of the old plant. The Schutte & Koerting Company have bought property at Cornwell, Pa., and are building a one-story brass foundry, power house and testing station.—H. S.

COLUMBUS, OHIO

FEBRUARY 3, 1913.

The metal market in Columbus and central Ohio has weakened some in sympathy with conditions in eastern markets. Trade has fallen off to a small extent, due principally to the declining market which is keeping purchasers away. They believe that

prices may come down even more. General trade is as good as usual and there is no marked falling off in the consumption of metals. The policy is to buy from hand to mouth, as it were. Aluminum remains firm in every particular and prices are about 25 to 26 cents for scrap and 30 cents for casting. Brass is lower and scrap brass is quoted at 12 cents. Tin and smelter are both weaker. Babbitt metal is one of the strong points in the market. The supply in this section is not very large and the weakened condition is expected to pass away soon.—J. W. L.

DETROIT, MICHIGAN

FEBRUARY 3, 1913.

Brass and aluminum manufacturers in Detroit as a general thing express satisfaction regarding the first month of the year. The last four weeks certainly forecast what is before metal manufacturers. Pessimistic expressions that heretofore have been heard regarding trade at this time of the year have failed to appear and now nothing but the most encouraging reports are heard on all sides. Every brass and aluminum factory in the city is running full handed and has plenty of orders to keep it busy for some time to come. The demand for Detroit-made goods is on the increase. This steady advance, while in some lines at times has been slow, has continued for many months. So good is the outlook at present that manufacturers in many instances will be forced to increase their factory facilities.

The demand for plumbers' supplies and other building material continues good, as dealers apparently are stocking up for the trade that is expected much earlier this season than usual. Then again the winter has been so open, especially in Detroit and lower Michigan, that building operations have continued quite brisk during the last two cold months. The present open winter is proving a great advantage to all manufacturers in Detroit. A year ago now they were experiencing the greatest difficulty to get coal and also sufficient cars to move manufactured stock. No congestion is experienced now, and the season is so far advanced that there is little prospect of any.

The automobile show, which opened in Detroit on January 29 and continued for one week attracted many brass and aluminum manufacturers. Most of the manufacturers who cater to the automobile trade made fine accessorary displays. The automobile business here was rather quiet just preceding the show, and from now on the factories will continue operations with renewed energy; many, like the Ford, the Cadillac and the Packard, have shown no let up, all through the late fall and early winter. The aluminum and brass accessory plants are all running under heavy pressure and will continue so indefinitely. All these manufacturers are anticipating a much greater demand the present year than at any other period since the automobile industry has begun to develop.

I. M. Jacobson & Sons, metal merchants and manufacturers of all metal alloys, have opened a metal warehouse and works at 70-72 Catherine street, in connection with their general offices in the Ford Building.

Detroit at the present time is probably producing more trolley wheels than any other city in the country. This industry has developed very rapidly here during the last two years. These wheels are made of brass and are growing in demand all over the country. The manufacture of jewelry is rather quiet at present and no great improvement in these conditions is expected for some time to come.—F. J. H.

LOUISVILLE, KY.

FEBRUARY 3, 1913.

Although the demand for new equipment and repairs by distillers has practically ceased, business among the local members of the metal trade continues good in almost all lines. Reports indicate that for the month of January the volume of business was much in excess of that of last year, and everything points to a continuance of this very satisfactory condition. The principal activity at present seems to be in the plating end of the business, although all lines are fully engaged.

Since about the first of October the firm of Rademaker & Shadt, both members of which were formerly molders in the foundry of the Art Brass & Plating Works, of Louisville, has been operating the foundry of the latter concern, under the name of the Independent Brass Foundry, and has been doing a very good business. The firm still handles the work of the Art Brass & Plating Works, and is getting a good deal of other business as well.

The Art Brass & Plating Works has been busy getting out an initial order of 1,000 gasoline gauges for the Clark Motor Car Company, of Louisville. The gasoline gauge is a patented device for use on automobiles, indicating, as its name implies, the amount of gasoline in the storage tank. Mr. Clark, a member of the Clark Motor Car Company, has been exhibiting the gauge at the Chicago Automobile Show. Brass is the principal metal used in its construction.

The Southern Plating Works, as the shop recently established at Wenzel and Walnut streets in Louisville by Frank Oyler was known, has gone out of business, and the premises where it was conducted are now occupied by the American Plating & Manufacturing Company, which formerly was located at Ninth and Market streets. It is reported that this concern has acquired some of the equipment of the Frederick-Ruggles Company, which recently dissolved by the bankruptcy route.

The American Brass & Plating Company has been incorporated in Louisville with a capital stock of $8,000 by Thomas J. Hines and John J. Brennan, of the coppersmithing firm of Hines & Ritchie, and J. A. McGill, who was for many years with the Todd-Donigan Iron Company and the Hilton Collins Singletree Company, both of Louisville. The company was organized to take over the business of the Houser Manufacturing Company, and will, like that concern, conduct a general brass and plating business. Mr. Houser will remain with the new company as superintendent, and Mr. McGill will be its general manager.—G. D. C.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Meriden Scrap Metal Company, Meriden, Conn., is now being dissolved and will be out of existence after this month.

The Harley Company, Springfield, Mass., has succeeded The Millet & Harley Company, manufacturers of brass and aluminum castings.

Hess & Son, manufacturers of Tinol products, soft solder paste, Philadelphia, Pa., have removed their offices and salesroom to 1031 Chestnut street.

The Crane Company, manufacturers of valves, Chicago, have moved their general offices to the new twelve-story building at 836 South Michigan avenue.

The Gray Iron Foundry Company, Reading, Pa., have purchased the plant of the National Brass & Iron Company of that city, and are in the market for some new equipment.

It is reported that The National Cash Register Company of Dayton, Ohio, contemplates additions to their Toronto, Ontario, plant, including the probable erection of a brass foundry.

The Monarch Aluminum Ware Company have established a new plant on East Forty-ninth street, Cleveland, Ohio, where they will make a complete line of aluminum cooking utensils. Raymond Deutsch is the manager.

The Payson Manufacturing Company, manufacturers of hardware, Chicago, Ill., will erect a three-story brick addition, 25 by 150 feet, to their plant on Jackson Boulevard. This concern has a brass foundry, metal working shop and plating room.

The Jackson Ornamental Iron and Bronze Works, Jackson, Tenn., have issued $8,000 worth of new stock to meet the cost of additional improvements to their plant. Practically all of this amount was subscribed by the stockholders present at the meeting.

The Tate Electric, Ltd., Walkerville, Ontario, has recently been organized to build electric pleasure and commercial cars. A site has been secured and a brick and steel plant, covering 42,000 square feet, will be erected. Albert Kaltschmidt is the manager.

The Duplex Metals Company, Chester, Pa., manufacturers of copper-clad steel wire, have installed a plate mill and are now prepared to turn out copper-clad steel sheets, strips, plates and shapes. This improvement more than doubles the capacity of their plant.

The New Departure Manufacturing Company, manufacturers of hardware specialties, Bristol, Conn., will add two stories to their three-story office and factory building, which is 215 by 62 feet. They have a foundry and plating room in connection with their factory.

The Doherty Manufacturing Company, Ltd., manufacturers of steel ranges, Sarnia, Ontario, are erecting a three-story addition, 40 by 100 feet, to their plant, and will install a two ton electric elevator. This concern has a nickel plating plant and James Doherty is the general manager.

The Victoria Metal Company, smelters, refiners and founders of brass, bronze, aluminum and white metal alloys, Erie, Penn., are erecting an addition to their foundry 50 by 100 feet. This company is now specializing on pattern castings, either in the rough or finished, together with brass, bronze or aluminum job work.

L. Ferdinand Zerkel, Luray, Virginia, who has been identified with the building material business for some years, has established himself as a commission jobber in this line, and desires correspondence with manufacturers who want their products placed before dealers and buyers in the states of Virginia and West Virginia.

The Victor Brass Manufacturing Company, recently incorporated at Cleveland, Ohio, for the manufacture of plumbers' high-grade brass goods, report that they are now operating. The officers of the company are: Low Bremen, president; Theodore Moran, vice-president; Nicholas McGrath, secretary-treasurer; J. H. Lyons, manager.

The Pequot Brass Foundry of Norwich, Conn., have incorporated and are erecting a foundry building 40 by 100 feet, in which they will install eight furnaces. They will be ready to begin operations about the first of March. The officers of the company are F. E. Green, president; E. A. Tracy, secretary-treasurer; F. M. Green, manager.

The Kalamazoo Stove Company, Kalamazoo, Mich., have recently purchased an acre and a half of land on which they will erect a one-story furnace building. They have also purchased a lot 130 by 104 feet on Main street, on which they will put up a three-story salesroom and general office. They have both a metal working shop and plating room.

The Maiwurm Aluminum Works, Erie, Pa., have increased their capital stock from $10,000 to $25,000. They make aluminum kitchen utensils by a process for which they use special machinery of their own make. Two thousand pounds of metal are melted daily. Paul Maiwurm is president and general manager and Julius E. Curtze, secretary and treasurer.

The Camden Copper Works, Camden, N. J., who have been doing all kinds of copper work and machine work for the past eight years, have incorporated in order to provide more capital, and there will be no change in the management. This company specializes in copper work for extract plants, sugar refineries and candy manufacturers. B. A. Ahlberg is the president.

The Cleveland Galvanizing Works Company, manufacturers of chains, pattern letters, etc., Cleveland, Ohio, are about to begin the erection of a five-story factory addition, 40 by 140 feet. A new power plant and some necessary equipment will be installed. This company recently added to its chain products two new types of weldless wire chain, and operate a small brass foundry exclusively for their own work.

The Fuller & Sons Manufacturing Company, Kalamazoo, Mich., was recently incorporated with a capital stock of $100,000 to take over the business of the Michigan Automobile Company, Ltd., manufacturers of automobile parts. This firm has had ten years' experience in this line and the reorganization took place in order that the business might be enlarged. Transmissions, lever sets and clutches are also manufactured.

The Department of Public Safety, Philadelphia, Pa., have organized a Fire Prevention Commission in an endeavor to improve such conditions throughout the state and to control the fire danger and loss in the city. The Commission is composed of Powell Evans, chairman; Jesse D. Burke, Walter F. Ballinger, D. Knickerbocker Boyd, William C. Haddock, Charles A. Hexamer, James C. Jones, R. H. Newbern and Robert S. Perry.

The Niagara Alkali Company, Niagara Falls, N. Y., announce that work is now rapidly progressing on an addition to their plant which will increase their output to 10,000 tons per annum. The prices of "Niagalk," which is the trade name for their electrolytic caustic potash products, have also been reduced to a point where, the company says, the American consumer need have no fear of a restoration of the former exorbitant prices charged for potash.

The Stamford German Silver Company, Stamford, Conn., notice of whose incorporation was published in our last issue, have completed their buildings and will be ready for operations some time in April. They will manufacture German silver in sheet, rod and wire; also nickel anodes. The officers are: William B. Beckley, president; George C. Harrison, secretary; J. G. MacKay, treasurer and general manager; Charles H. Guild, master mechanic.

The National Sheet Metal Company, manufacturers of all sizes of plated sheet metals, Peru, Illinois, report, through H. Schussler, that through the installation of a new machine in their plant they are now in a position to put out double the amount of metal than heretofore. They claim that their product is superior to any other plated sheet metal on the market and can guarantee prompt delivery. This firm states that they doubled their output in 1912 and with their new equipment anticipate better results this year.

One thousand dollars a minute for fifty minutes was the cost of a fire which destroyed the brass and aluminum foundry of the Buick Motor Company at Flint, Mich., January 17. The blaze started from the bursting of a feed pipe leading to a Jackson furnace, and the place was in flames in an instant. Only about 200 men have been laid off, and this is only temporary, as the work of reorganization is already well under way. The loss is fully covered by insurance, and the management announces that the 1913 output of 30,000 cars will not be affected. The Buick employs 5,000 men and the average monthly pay roll is $406,646. This company is one of the very few motor building plants which have their own electro-plating works.

Guion Thompson, American Institute of Electrical Engineers and R. G. MacPherson, American Society of Mechanical Engineers, have opened an office at 27 West Main street, Waterbury, Conn., under the name of Thompson & MacPherson, for the purpose of practicing a general consulting engineering business and propose to make a specialty of supervising the operation and maintenance of industrial power plants, drives, heating, ventilating, refrigerating and illuminating equipments, in order that this apparatus may be operated and maintained at its maximum efficiency. They will also examine, at the manufacturers' plant, new machinery so that the purchaser may be assured that it will meet with the specifications upon which it was purchased. Mr. Thompson is well known as a former electrical engineer of the American Brass Company.

The Indianapolis Brass Company, Indianapolis, Ind., in harmony with its profit-sharing plan, has distributed $1,000 to 20 of its employees, representing part of the next earnings for 1912.

The individual amounts ranged from $16 to $62, based on the wage earnings. Enclosed with the checks was a letter which read, in part: "This money is not a gift or a bonus. It represents something which you have earned and which was not counted in your wages. By making your work count for economy of time and material and efficiency of labor you have 'cut the corners' and made a profit for the business." The company says the plan has given the employees the kind of spirit a stockholder has in working for the interest of the company. M. W. Kelly is president of the company; James H. Drew, secretary, and T. A. Lavelle, general manager.

Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock a. m., February 25, and publicly opened immediately thereafter to furnish at the Navy Yard, Brooklyn, N. Y., a quantity of naval supplies, as follows: Sch. 5170, lead pipe; Sch. 5175, brass nuts, semi-finished; sheet brass, soft rolled; brass pipe and tubing, seamless drawn; copper tubing, seamless drawn. At the Navy Yard, Boston, Mass., Sch. 5161, six oil burning furnaces; motor driven buffing lathe; hydraulic pipe bending press. At the Navy Yard, Mare Island, Cal., March 5, Sch. 5177, brass squirt cans; rolled bronze, medium round; Sch. 5179, round brass rods. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office nearest each yard, or to the bureau.

T. J. Cowie, Paymaster-General, U. S. N.

The Burr Company, founders and machinists, Champaign, Ill., report, through H. F. Post, manager, that they have under construction a foundry building 132 feet in length with center bay 50 feet span with traveling crane and 2 side wings 35 feet each, one wing of which will be used for molding purposes, not requiring crane service, the other wing to be used for a cupola loft, cleaning rooms, core oven, core rooms, heating, etc. There will also be a boiler plant and storage sheds lining the railway service track for all of the supplies for foundry and structural shop. Necessary yard cranes for unloading from track and reloading for shipment. Office building, pattern and template shop and pattern storage is located in a two-story brick building 37 by 100 feet, of sufficient distance from foundry and structural shops to be free from excessive annoyance. This plant is located on track with switching facilities from Illinois Central, New York Central Lines, Wabash and Interurban systems.

INCREASE OF CAPITAL STOCK

The Imperial Brass Manufacturing Company, Chicago, has increased its capital stock from $100,000 to $200,000.

The Frost Manufacturing Company, Kenosha, Wis., manufacturer of plumbers' supplies, has increased its capital stock from $50,000 to $200,000.

The Foster Machine Company, manufacturer of metal working machinery, Elkhart, Indiana, has filed notice of an increase in its capital stock from $25,000 to $150,000.

Business For Sale.—In the Trade Want Pages of this number there is advertised the sale of a business which the owner declares to be a valuable and profitable one for a man with executive ability and a knowledge of the manufacture of metal goods. Further particulars may be obtained by writing or calling at The Metal Industry, 99 John street, New York City.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

The Plastic Metal Company, Inc., Brooklyn, N. Y. Capital, $300,000. To manufacture metals. Incorporators: James S. Watson, W. E. Jacobs and P. A. Lee, all of Manhattan, N. Y.

Columbia Metals Corporation, Lynbrook, L. I., N. Y. Capital, $20,000. To manufacture metals. Incorporators: E. J. Forban, D. A. Cashin and F. B. Knowlton, all of Manhattan, N. Y.

PRINTED MATTER

Graphite Productions.—The largest and most complete production catalog ever issued by the Joseph Dixon Crucible Company, Jersey City, N. J., is now being mailed to the thousands of manufacturers, jobbers, purchasing agents and others interested in graphite, crucibles, paint, lubricants, pencils and the other productions of the Dixon Company. Though over one hundred pages of type and illustrations are used, this catalog does not attempt to carry a full description of the entire Dixon line and only a few of the hundreds of Dixon's American Graphite Pencils are listed. The Dixon Company attach a peculiar value to their production catalog inasmuch as it serves to acquaint those who are already users of one form of graphite with its many other forms and uses. If you are particularly interested in graphite products you are invited to send for a copy of this catalog.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

New York, February 10, 1913.

COPPER.

On January 14, last, we were able to add to our report that the copper market had that day gone to smash, Electrolytic was selling at 17 cents with Lake at 17¼. Since that date, with heavy breaks in the London standard market, the market here has been utterly demoralized.

The copper market is again an "open market," the agreement among producers last year to hold the price at 17¾ cents, regardless of any demand from consumers, was a miserable failure—as it well deserved to be—and today we have some producers selling Electro at 16 cents, with March and April offered at 15⅞ to ¾ and as far as it is possible to find out the leading selling interests in the country are holding their copper for, possibly 16⅜ or better—just as they held it at 17¾ or better for the last three months.

With mills busy all over the country, with brass and copper manufacturers doing the largest business they have ever had, it is but natural to ask, with these exceptional conditions in the copper manufacturing trade, why this demoralization in the copper market? With conditions never better in the history of the trade, why this demoralization in copper, the leading industry in the country next to iron and steel? And today consumers are afraid to come in and buy. The cause of all this trouble is, we are told, "The Balkan War," "unsettlement in all financial markets in Europe," etc., etc. We will grant that the money markets are very much disturbed and that helps to confirm us in the point we are coming to. The war in Europe has interfered very little so far with actual trade in the leading countries in Europe. See the increase in trade in Great Britain, the enormous expansion in German trade and the vast increase in trade in France. These facts tell their own story. We believe the whole trouble with the copper market is Wall Street—or rather the Wall Street interests that control the selling of copper.

We were talking only a few days ago with a well known copper producing and selling interest and one who knows the consuming end of the business better than any one else in the trade. We suggested, with more or less fear and trembling, that the copper market was suffering from "too much Wall Street"—we nearly fell off our seat when he came back at us with, "That's it exactly—if we had merchants at the head of the selling business instead of Wall Street operators who know no more about the copper business than the man on the street, we would have the copper industry as the leading industry in the country with the confidence of the trade be-

hind it. A business run as a merchant runs his business with the consumers' end always in view and the consumers' interests protected for the reason that consumers' interests are the interests of the copper producer, instead of Wall Street and stock jobbing as now."

The speculative market in standard copper in London broke when the Balkan War started—now we claim there is nothing to show this war seriously affected the actual consumption of the red metal. According to metal statistics the European consumption increased during 1912, 10,000 tons or 20,000,000 pounds over 1911, while the exports in 1912 decreased 8,505,781 pounds. In this connection it must be noted that the exports in 1911 were exceptionally heavy, 754,902,233 pounds against 722,431,494 in 1910.

The point we wish to emphasize in connection with these heavy exports in 1911 is that they did not in any way represent consumption. Money in Europe was very cheap and during that time and before the war it was cheaper to carry the surplus copper in Europe than it could be carried here—at the same time it was all classed as "consumption." Since the war money has been very high in Europe and on account of these high rates no surplus copper has been exported and stocks here have increased accordingly. We only call attention to this palpable manipulation of the copper market for the purpose of showing the Wall Street methods adopted by the leading interests we have already alluded to.

The copper market today is weak and unsettled, consumers are picking up a little at around 15¾ to 16 cents, but there is no confidence in the market or rather there is no confidence in the powers behind the copper market. Prices today, nominal, 15¾ to 16 cents, and the market looks like going lower.

TIN.

The unexpected always happens in Tin with the stock of tin in London reduced from 2285 tons January 1, to 704 tons on January 31, we have a decline for the month of ½ cent a pound in America and £1 in London, and since January 1 we have had a further decline of about 2 cents per pound.

We could give a lot of reasons for this state of affairs but they are really not worth a cent. There is only one safe way to play the tin market and this is, bank all you have on the unexpected and you will get their money. The market today is firmer at 49.50 spot. March and April, 49.00 to 49.25.

LEAD.

There has been no change in lead during the month. The Trust price has been held at 4.35 and the Independents have been selling as close to this as they could to get all the business they wanted. The feeling in the trade is that prices are likely to be advanced and sellers of futures are more or less shy about committing themselves far ahead.

SPELTER.

The present forced decline in the face of the good months for consumption drawing near looks very like manipulation. Prompt shipment in St. Louis is close to 6.50 and futures seem to be still easier.

ALUMINUM.

The Aluminum market has been quite active at around 26⅜ cents. The trade is very much exercised over the agitation of a reduction in the duty, "To be or not to be—that is the question." Whether—well, really, the point is whether, with apologies to "William," it were better to have the duty at 7 cents and increase the home consumption or reduce the duty and go to Europe for the balance of our supplies. The only maker at present in America cannot produce enough aluminum for our home consumption and rather than be dependent on Europe we feel that consumers would be benefited by an increased home consumption and plenty of free and open competition with the European market always open to call on at the first sign of any "corners."

ANTIMONY.

The aftermath of inflated prices is now gripping some of the trade and it is not a pleasant feeling. The market is suffering more or less from acute indigestion, quite a fashionable disease—overeating and overbuying brings it on and prices are all lower. Cooksons, 9.40 against 10 cents, Halletts, 9 cents against 9½ a month ago and the disease still has to run its course.

SILVER.

The silver market has taken quite a drop from the high levels of December and January. Today around 64, New York, and 28¾ in London.

PLATINUM.

The price holds fairly steady at around $51 per ounce for hard (10%) and $46 for ordinary refined.

QUICKSILVER.

The wholesale price stays around $40 with jobbing lots $41 to $42.

SHEET METALS.

The price of sheet copper has been reduced—more or less with the break in copper—the price is nominal with 21½ to 22 cents as the supposed base. Copper wire is lower. These prices can, of course, be shaded.

OLD METALS.

The old metal market has suffered from the smash in copper and business is almost at a standstill.—J. J. A.

JANUARY MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
COPPER.			
Lake	17.75	16.25	17.00
Electrolytic	17.65	16.00	16.77
Casting	17.50	15.90	16.50
TIN	50.70	49.85	50.50
LEAD	4.35	4.35	4.35
SPELTER	7.35	6.85	7.20
ANTIMONY (Hallett's)	9.30	9.00	9.15
SILVER	63¾	61½	62.93

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

	February 8, 1913.
Stocks of marketable copper of all kinds on hand at all points in the United States, January 1, 1913.	105,312,582
Production of marketable copper in the United States from all domestic and foreign sources during January, 1913	143,479,625
	248,792,207
Deliveries:	
For domestic consumption	65,210,030
For export	60,383,845
	125,593,875
Stocks of marketable copper of all kinds on hand at all points in the United States, February 1, 1913.	123,198,332
Stocks increased during the month of January	17,885,750

WATERBURY AVERAGE

The average price of lake copper per pound as determined monthly at Waterbury, Conn.:

1912—Average for year, 16.70. 1913—January, 17.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the Report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

INQUIRIES AND OPPORTUNITIES

Under our directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

Metal Prices, February 10, 1913

NEW METALS.	Price per lb. Cents.
COPPER—PIG AND INGOT AND OLD COPPER. Duty Free. Manufactured 2½c. per lb.	
Lake, carload lots	16.00
Electrolytic, carload lots	16.00
Casting, carload lots	15.75
TIN—Duty Free.	
Straits of Malacca, carload lots	49.50
LEAD—Duty Pig, Bars and Old, 2½c. per lb.; pipe and sheets, 2⅜c. per lb.	
Pig lead, carload lots	4.35
SPELTER—Duty 1⅜c. per lb. Sheets, 1⅝c. per lb.	
Western, carload lots	6.75
ALUMINUM—Duty Crude, 7c. per lb. Plates, sheets, bars and rods, 11c. per lb.	
Small lots, f. o. b. factory	25.20
100 lb. lots, f. o. b. factory	23.20
Ton lots, f. o. b. factory	22.20
ANTIMONY—Duty 1½c. per lb.	
Cookson's cask lots, nominal	9.50
Hallett's cask lots	9.00
Hungarian grade	8.25
NICKEL—Duty Ingot, 6c. per lb. Sheet, strip and wire 35 per cent. ad valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity	40 to .45
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL—Duty 20 per cent	.90
MAGNESIUM METAL—Duty 3 cents per pound and 25 per cent. ad valorem (100 lb. lots)	1.50
BISMUTH—Duty free	2.10
CADMIUM—Duty free	.90
CHROMIUM METAL—Duty 25 per cent. ad valorem	.98
QUICKSILVER—Duty 7c. per lb.	.57
	Price per oz.
GOLD—Duty free	$20.67
PLATINUM—Duty free	46.00
SILVER—Government Assay Bars—Duty free	.64

INGOT METALS.			Price per lb. Cents.	
Silicon Copper, 10%	according to quantity		27	to 32
Silicon Copper, 20%	"	"	34	to 36
Silicon Copper, 30% guaranteed	"	"	36	to 38
Phosphor Copper, guaranteed 10%	"	"	25	to 28
Phosphor Copper, guaranteed 15%	"	"	24	to 28
Manganese Copper, 25%	"	"	27	to 30
Phosphor Tin, guaranteed 5%	"	"	60	to 63
Phosphor Tin, no guarantee	"	"	55	to 57
Brass Ingot, Yellow	"	"	10	to 12
Brass Ingot, Red	"	"	13	to 15
Bronze Ingot	"	"	14	to 15
Manganese Bronze	"	"	19½	to 21
Phosphor Bronze	"	"	13	to 16
Casting Aluminum Alloys	"	"	25	to 27

PHOSPHORUS—Duty 18c. per lb. According to quantity	30	to 35

Dealers' Buying Prices. Cents per lb.	OLD METALS.	Dealers' Selling Prices. Cents per lb.
14.00 to 14.50	Heavy Cut Copper	15.50 to 15.75
13.50 to 14.00	Copper Wire	14.50 to 15.00
12.00 to 12.50	Light Copper	13.50 to 13.75
12.00 to 12.50	Heavy Mach. Comp	13.00 to 13.50
8.25 to 8.50	Heavy Brass	9.50 to 10.00
7.00 to 7.50	Light Brass	8.00 to 8.50
8.00 to 8.25	No. 1 Yellow Brass Turnings	8.75 to 9.00
10.50 to 11.00	No. 1 Comp. Turnings	12.00 to 12.50
3.75 to ——	Heavy Lead	—— to 4.00
5.50 to ——	Zinc Scrap	—— to 6.00
10.00 to 12.00	Scrap Aluminum, turnings	13.00 to 15.00
15.00 to 19.00	Scrap Aluminum, cast, alloyed	18.00 to 22.00
20.00 to 22.00	Scrap Aluminum, sheet (new)	23.00 to 25.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 23.00	Old Nickel	23.00 to 26.00

PRICES OF SHEET COPPER.

BASE PRICE, 22 Cents per Lb. Net.

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 ins.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 ins.	4	6							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ..... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ..... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ..... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ..... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ..... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ..... 2c.

For Polishing both sides, double the above price.

The Polishing extra for **Circles and Segments** to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ..... 1c.

ZINC—Duty, sheet, 1⅝c. per lb.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	8.75 less 8%
Casks, jobbers' prices	9½
Open casks, jobbers' prices	10

Metal Prices, February 10, 1913

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect January 27, 1913, and until further notice.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.16¼	$0.18⅛	$0.19½
Wire	.16	.18½	.19½
Rod	.16	.18½	.20½
Brazed tubing	.20¾	——	.24¼
Open seam tubing	.19⅝	——	.22⅛
Angles and channels, plain	.20	——	.22⅝

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

To customers who buy 5,000 lbs. or less per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.17½	$0.19⅝	$0.20¾
Wire	.17¼	.19⅝	.20¾
Rod	.17¼	.20⅛	.21¾
Brazed tubing	.22	——	.25½
Open seam tubing	.20⅞	——	.23½
Angles and channels, plain	.21¼	——	.24

Net extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

17½c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	23c.	per lb. base
100 lbs. to 300 lbs. in one order	23½c.	" " "
Less than 100 lbs. in one order	25c.	" " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, 21c. per lb.
Seamless Copper Tubing, 25c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe Size	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb.	29	28	23	22	21	21	21	21	21	21	21	22	23	25	27	28

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1¼ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	69

Discount 50%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Red	18½c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	16½c.	" "
" " " Rectangular sheets other than Sheathing	19c.	" "
" " " Rod	16½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 26c. net.
German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.
Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Not over 18 in. in width, not thinner than 28 B. S. Gauge, 2c. above price of pig tin in same quantity.
Not over 35 in. in width, not thinner than 22 B. S. Gauge, 3c. above price of pig tin.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	1 ton.	500 lbs.	50 lbs.	Less than 50 lbs.
20 and heavier	3-30	33c.	34c.	36c.	38c.
	3-30	34c.	35c.	37c.	39c.
21 to 24 inclusive	30-48	36c.	37c.	39c.	41c.
	48-60	39c.	40c.	42c.	44c.
25 and 26	3-30	35c.	36c.	38c.	40c.
	30-48	37c.	38c.	40c.	42c.
27	3-30	36c.	37c.	39c.	41c.
	30-48	39c.	40c.	42c.	44c.
28	3-30	37c.	38c.	40c.	42c.
	30-48	40c.	41c.	43c.	45c.
29	3-30	38c.	39c.	41c.	43c.
	30-48	42c.	43c.	45c.	47c.
30	3-30	39c.	40c.	42c.	44c.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. Charges made for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters. BASE PRICE, 24 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	19	9	8	15	22
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	..	27	26	26	23	22	20	20	20	20	26	30	56
18.	.049.	..	..	..	..	32	29	28	27	24	25	25	25	..	..	..	..	..
20.	.035.	116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	80
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..
24.	.022.	187	132	107	87	78	72	61	59	65	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb.	33	33½	33½	34	34½	35	35½	36	37	38	39	44	47

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4 per cent.	to	No.	19,	B. & S.	Gauge,	inclusive	$0.60
6	"	"	19,	"	"	"	.70
9	"	"	19,	"	"	"	.85
12	"	"	19,	"	"	"	1.00
15	"	"	19,	"	"	"	1.15
16	"	"	19,	"	"	"	1.20
18	"	"	19,	"	"	"	1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.
For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 2c. below to 6c. above the price of bullion.
Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.